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SEVEN DOLLARS

CIO

THE MAGAZINE FOR INFORMATION EXECUTIVES

COVER STORY:

Looking For A Few Good Global Nets

Annual Survey: CEOs Want More CIO Leadership

The U.S. Marine Corps'
Major Chip Lohman

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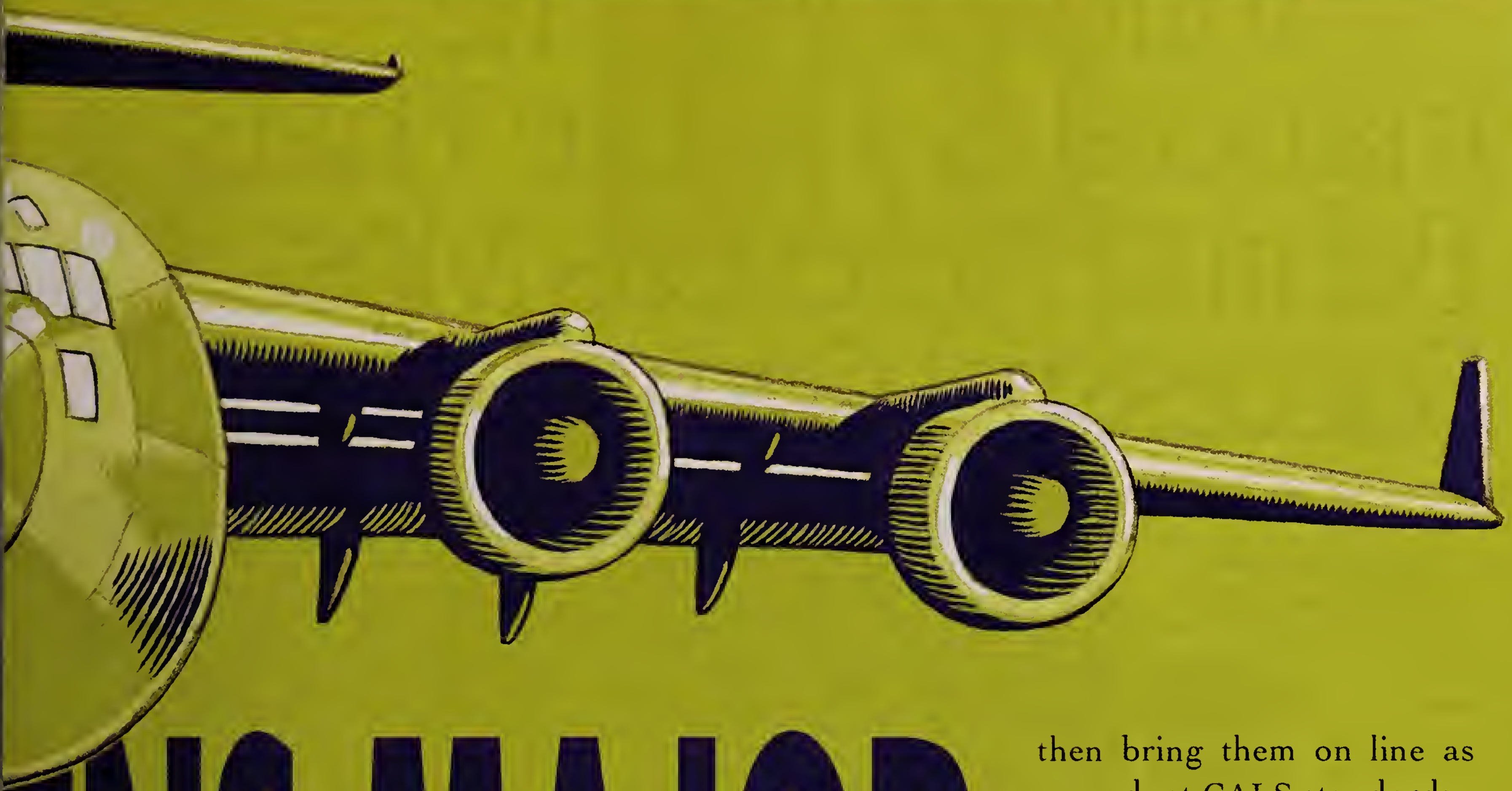

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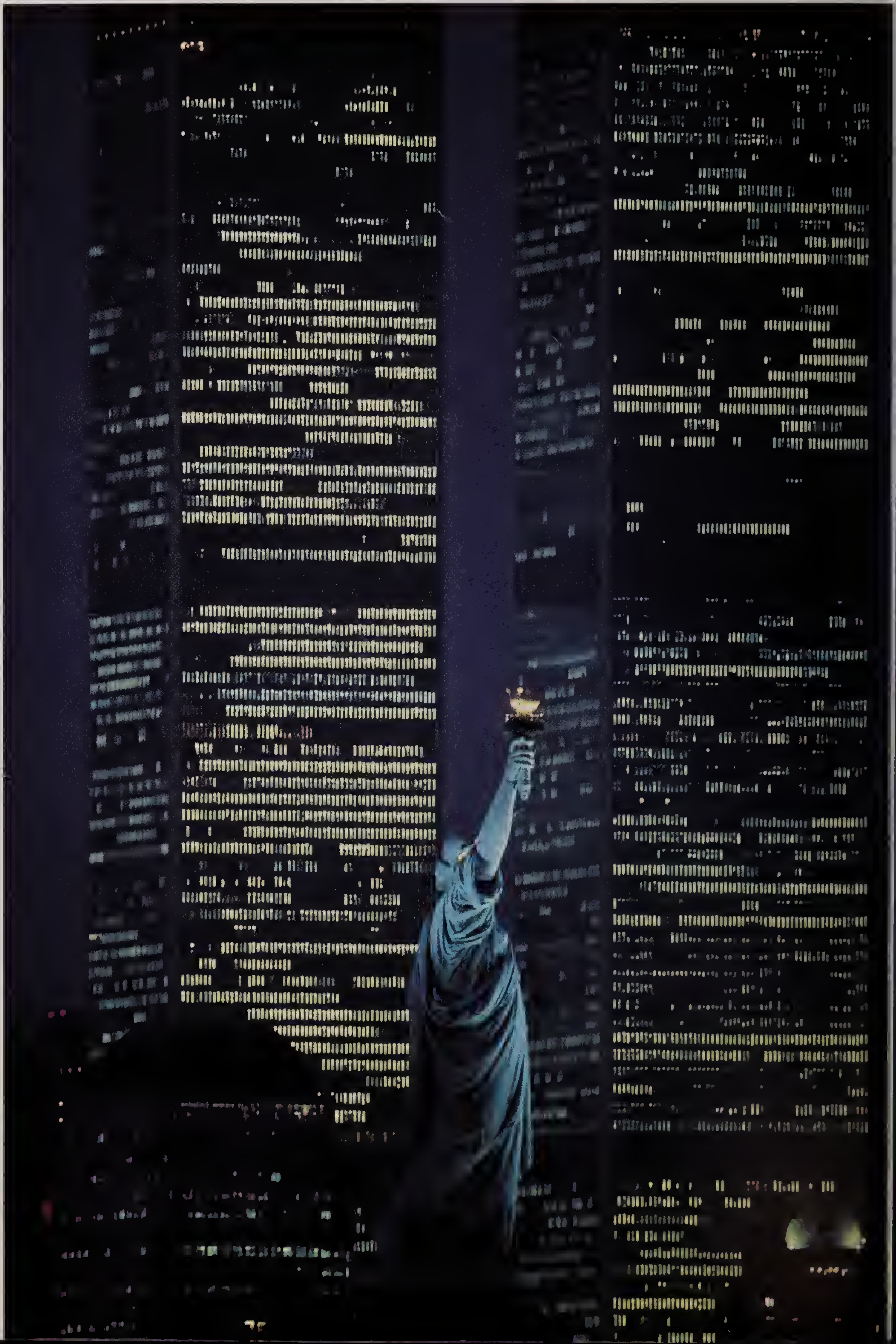

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Cover Photo of Chip Lohman
by Katherine Lambert

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By Meghan O'Leary

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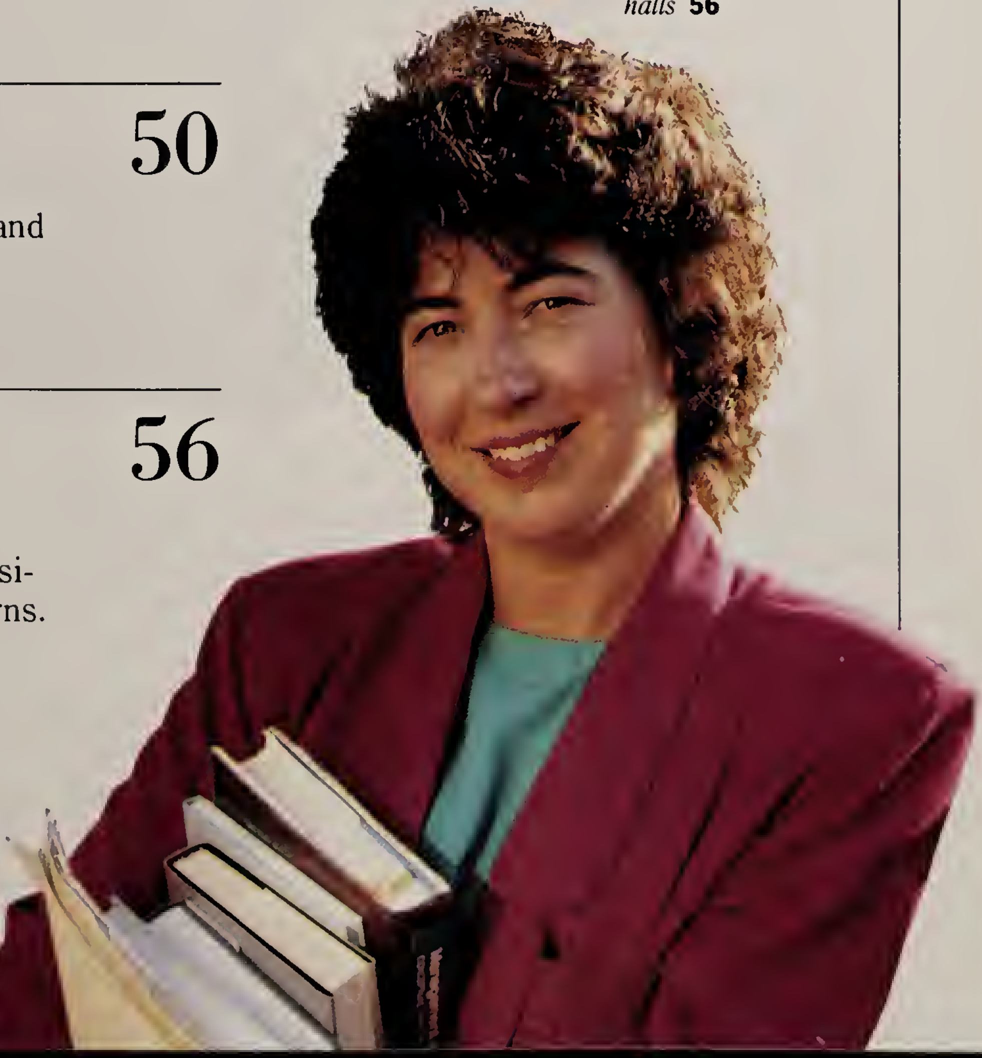

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With the recession putting the squeeze on IS budgets everywhere, CIOs must learn to do more with less—and be able to prove it, too.

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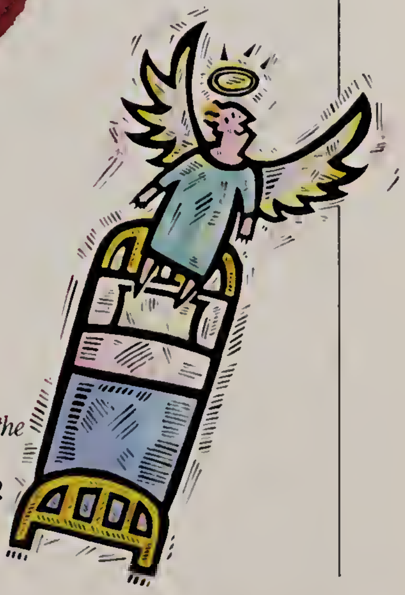

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Vice President
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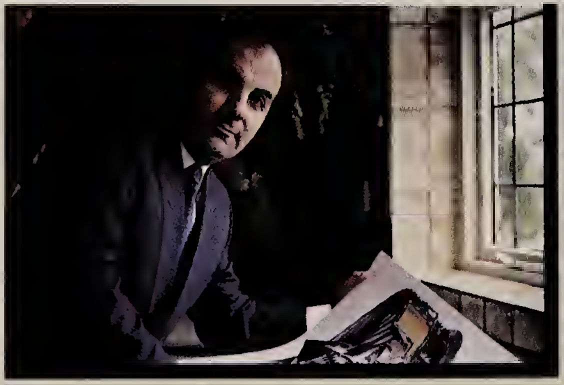

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Rolls-Royce

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SONY Corporation

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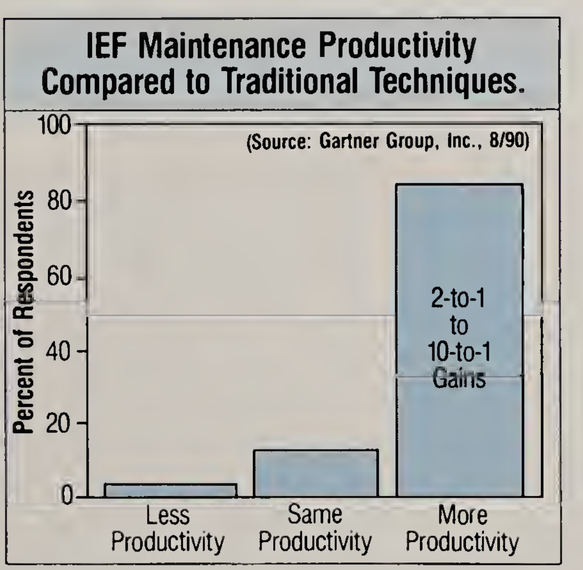
The quality of IEF-developed systems is remarkable. In recent CASE research by The Gartner Group, application developers were asked to report the number of abends they had experienced. (An "abend" is a system failure or "lock-up" caused by code defects.) *IEF developers reported zero defects—not one abend had occurred in IEF-generated code.*

Maintenance productivity gains of up to 10-to-1.

In this same study, developers were asked to compare IEF maintenance productivity with their former methods. Of those responding, *more than 80 percent had experienced gains of from 2-to-1 to 10-to-1.* (See chart.)

Specifications always match the executing application.

With the IEF, application changes are made to diagrams, not code. So, for the life of your system, specifications will always match the executing application. The Gartner Group research showed that *all* IEF users who reported making application changes made *all* changes at the diagram level.



Developers were asked to compare IEF maintenance to former methods. Of those responding, more than 80% reported productivity gains of from 2-to-1 to 10-to-1.

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We are committed to standards.

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The leadership vacuum is a topic trumpeted in the business press regularly. It is also the subject of a variety of management books published in the last few years. So it is not surprising to discover that leadership is an issue that has penetrated the CIO ranks.

One of the major findings of the third annual *CIO*/Coopers & Lybrand survey revealed that top executives are increasingly looking to information executives to play more of a leadership role in infusing information technology into the corporate culture.

In our article, "The Call for Leadership," beginning on Page 22, Contributing Writer David Freedman reports on the results of the survey, which polled 201 non-IS executives on their attitudes and expectations of CIOs. Top executives reported that CIOs have or should have significant involvement in formulating business strategies. C&L's Ronald Brzezinski, a partner in the company's IT practice, interprets this result as a signal that the CIO has been largely accepted into the corporate management ranks. The challenge to CIOs now is to be far more proactive in taking a leadership role.

Fueling the expectation that CIOs will take a stronger leadership role in the organization, three-quarters of the executives reported IT is a significant component of the business strategy for achieving competitive advantage. Brzezinski also noted that IT is among the top 10 subjects raised in questions asked at stockholder meetings. Top executives realize they are not experts on information management and are looking to CIOs to close that gap.

Further supporting the importance of leadership, the fifth annual Index Group survey on critical issues faced by top IS executives revealed that improving leadership skills ranked seventh, up from 10th place last year. (Please see story on Page 18). This ranking is particularly interesting because the issue of leadership was not reported at all during the first three years of the survey.

Leadership skills are certainly necessary for those CIOs creating global networks today (see "Globe Trotters," Page 42). The task requires the vision to operate in uncertain, largely uncharted environments. Senior Writer Meghan O'Leary reports the strategies information executives at United Parcel Service, the U.S. Marine Corps, Turner Corp. and Dow Chemical Co. employed to get their global networks up and running.

Vision is a term that may be overworked today, but leadership requires the ability to develop a vision of what the enterprise can become. The CIO is in the enviable position of being seen as an executive who can help fill the leadership vacuum.

Marcia Blumenthal

PHOTO BY WEBB CHAPPELL

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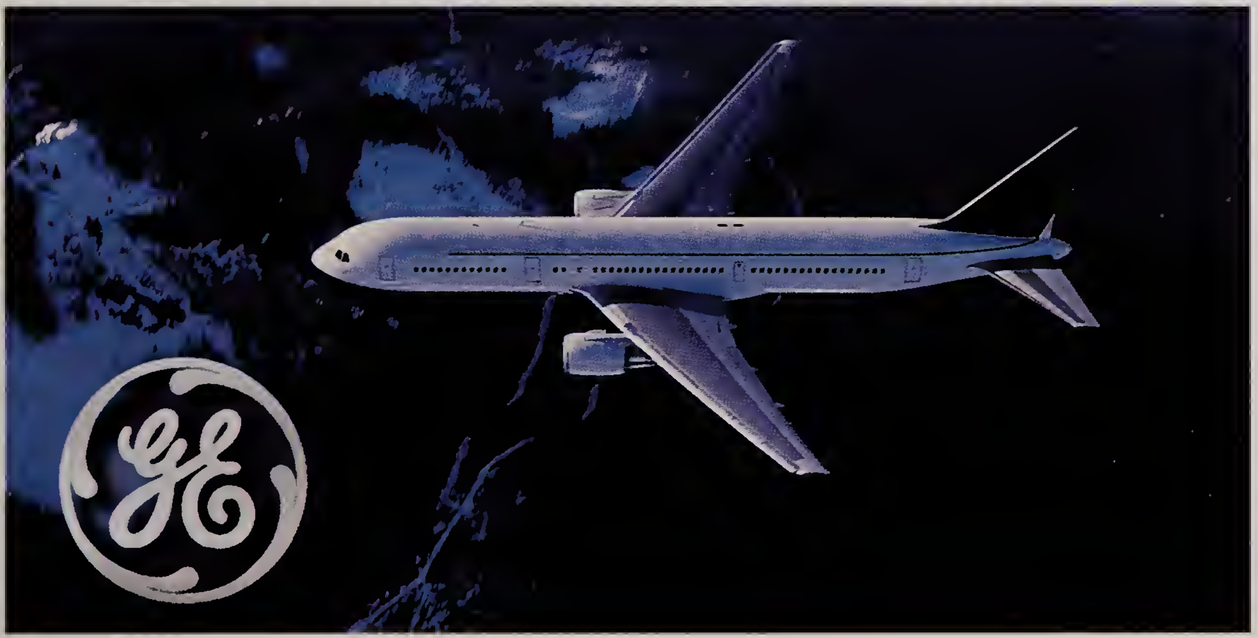

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LETTER FROM THE PUBLISHER

PHOTO BY GEORGE SIMIAN

Welcome to the January issue of *CIO* magazine. As we move into 1992, I'd like to share with you some feedback I've obtained recently from senior executives about the lack of quantification of bottom-line IT business benefits, and suggest how the CIO can address these concerns in the new year.

The chief complaint I hear is that senior management wants to understand the *results* of its IT investments. This desire for ongoing information and justification will continue well into the '90s, even as the pace of economic recovery increases, and will have a strong impact on management's expectations of the CIO.

As all of you know, up-front justification of IT investments—the articulation of objectives, value and projected bottom-line benefits—is critical to winning management support and funding. But just as critical, and unfortunately often neglected, is the process of *marketing the results* of technology investments corporatewide.

Essentially, the effective CIO must also be an effective marketer, adept at demystifying technology and promoting its bottom-line benefits in layman's language throughout the organization. Those who neglect this vital function are unlikely to win support for future strategic IT investments. In the coming year, CIO Publishing hopes you will take advantage of the information available through *CIO* magazine, our conference series, market research and other services to help you effectively market your organization and achievements.

If you have an IT success story that you feel would benefit your peers, our readers, I'd like to hear from you. Please write to me at CIO Publishing, 492 Old Connecticut Path, P.O. Box 9208, Framingham, MA 01701-9208.

Best wishes for a successful and healthy new year.

P.S. We invite you to join renowned management expert Peter Drucker and other business leaders at CIO's upcoming Perspectives conference, "The Business of IT: Finding the Payoff," to be held March 8-11 at Loews Coronado in San Diego. For more information, please refer to the conference brochure that accompanies this issue of the magazine. Or call our toll-free registration hot line at 800 366-0246.

Coming In CIO

Hire a Hacker?

Hackers can be disruptive, annoying or downright dangerous. They may also be important members of future IS staffs.

Getting Tough

Like other would-be EDI hubs, Sears has had to deal with entrenched opposition to change and pervasive EDI ignorance on the part of some suppliers. Now the retailer is beginning to realize that when it comes to the bottom line, sometimes a little coercion is necessary.

Small Packages

At their best, small companies provide a model of doing more with less and reacting swiftly and flexibly. And the same characteristics that make small companies economic sprinters can also put them out in front in technology.

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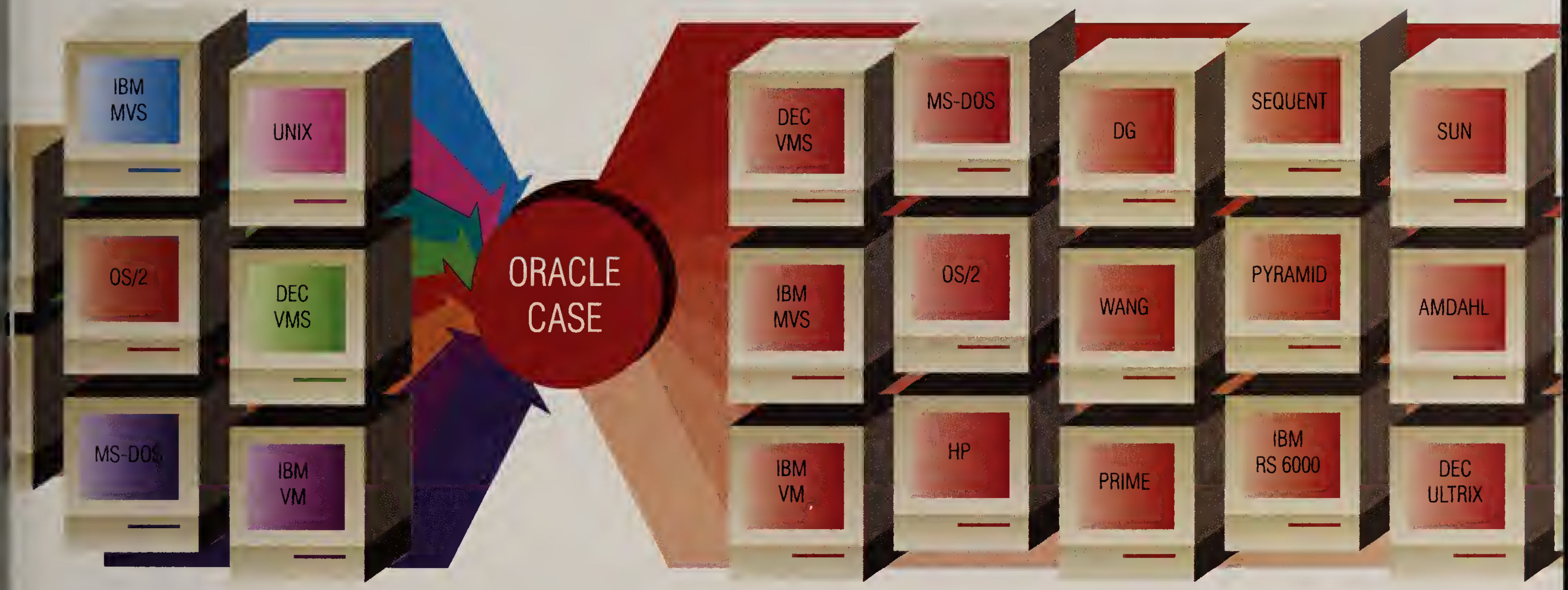

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ARTIFICIAL INTELLIGENCE

IS IT REAL OR ...

ILLUSTRATION BY JAMES KACZMAN

Alan Turing, the late British mathematician, believed that by the year 2000, artificial intelligence would have progressed to the point where it would be tough to tell a program mimicking human conversation from the real McCoy. Last November, the Boston Computer Museum hosted a contest to find out whether any of today's programs could live up to Turing's expectations.

In a blind test that limited conversations to specific subjects, human judges sitting at terminals tried to guess whether the entity at the other end of the network was another person or a crafty computer program. The program that fooled the most judges would win $1,500 in this first annual competition. The ultimate prize, $100,000 put up by New York philanthropist Hugh Loebner, awaits the first AI program that can bamboozle judges with human-like discussions on unrestricted, open-ended topics. Judging by the caliber of this year's crop, Loebner may be hanging onto his $100,000 for a good many years.

The human judges began the test by firing off conversational comments and questions on their terminals. On the topic of "women's clothing," the judge and the entity (human or program?) bantered about the high cost of clothes and the hot colors this season. The entity remarked that ocher was very "in." Could be a human. My wife likes ocher.

On the next terminal, devoted to "small talk," the entity professed not to have a favorite song. It also drew a blank on the existence of pop singer Paula Abdul. But it did volunteer its favorite movie: "Gone With the Wind." Sounds a bit fishy; even my dad's heard of Paula.

In a conversation restricted to "dry martinis," the entity could not furnish a meaningful answer when asked if it had ever drunk a dry martini. Who screened these programs, anyway?

There turned out to be six programs and two humans operating behind the scenes (two other entrants were scratched by technical glitches). Each program became flummoxed in the early going, failing to comprehend or respond to simple comments from the judges. In fact, some of these programs seemed hardly more advanced than the mock-psychologist program Eliza, developed in the 1960s. (You: "I am afraid of the dark." Eliza: "Tell me more about your dark.")

The winner was a commercially available program called PC Therapist from Thinking Software Inc. in Woodside, N.Y. Impressively, the program fooled half the judges into thinking it was human. However, its topic—"whimsical conversation"—seemed stacked in the program's favor. As any Lewis Carroll reader knows, the whole point of whimsical conversation is to make as little sense as possible.

LOVELY RITA

Digital Equipment Corp. and *Chain Store Age Executive* magazine have given the 1991 Retail Innovation Technology Award (or RITA) to JCPenney Co. in recognition of Penney's use of an interactive graphical interface in its highly ambitious catalog-forecasting and -ordering system.

The RITA is given for IT innovation in the retail industry. First and second runners-up for the 1991 award were Caldor and the Women's Specialty Retailing Group of U.S. Shoe Corp. (which operates Casual Corner, August Max, Petite Sophisticates and Caren Charles stores).

STUDENT INFORMATION

KNOWLEDGE NETWORKING

California Polytechnic State University at San Luis Obispo is the site of a pilot telecommunications project that could open up a whole new world of resources to students throughout the state.

ISIS (for Integrated Student Information Service) is a joint project of CalPoly, IBM, Pacific Bell and AT&T Network Systems that links the university's computers to its telephone system, allowing people who call for information or assistance to find the correct answers more quickly and easily.

The goal of the joint project is better service—initially to CalPoly students, eventually to students at other universities and to businesses and consumers nationwide. It is also designed to help the university contain administrative costs.

With ISIS, CalPoly students can link to university computers via phone to check their academic standing, and applicants for admission can call in to check the status of their applications.

The partners envision the system becoming a building block in a statewide knowledge network that would have the capacity to link all components of California's education system through the public telephone network.

The university hopes to extend admission access to secondary schools and community colleges. In addition, the technology promises to increase the opportunities for students to learn from off-campus locations.

ISIS's most useful and novel feature will be its ability to link a computerized student record to a telephone call and to direct and transfer the two at the same time. If a caller provides a student-ID number, the student's data file will automatically appear on a staff member's computer screen when the staffer takes the call.

The trick for students will be to keep those identification numbers out of the hands of their parents.

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TRENDLINES

CAREER MOVES

KATHERINE M. HUDSON, the Eastman-Kodak Co. director of corporate IS who presided over the ground-breaking reorganization-by-outsourcing of Kodak's IS function, has been tapped to head up a re-engineering effort at the company's Imaging Products Group. The move, which a Kodak official described as lateral, has Hudson remaining a vice president and retaining many of her old responsibilities. She will now report to the president of the imaging group and will guide the effort to revamp that organization's business processes.

RON J. PONDER, CIO of Federal Express, has jumped to Sprint/United Telecom, of Kansas City, Mo., effective this month. As executive vice president and CIO of the $8.7 billion telecommunications company, Ponder will report directly to Chairman and CEO William Esrey. A 15-year veteran of Federal Express, Ponder turned over the reins to **DENNIS JONES**, another longtime Federal veteran, formerly vice president of customer automation and revenue accounting.

Wakefern Food Corp., of Elizabeth, N.J., has promoted **NATAN TABAK** to the position of vice president and CIO. Tabak, who joined Wakefern as a management trainee in 1981 and most recently was its vice president for direct store delivery and bakery, will be responsible for communications and IS serving Wakefern and ShopRite supermarkets. Wakefern is a retailer-owned cooperative and the wholesale merchandising and distribution arm for ShopRite stores.

ON THE RECORD

From Samuel Pepys to Anne Frank, diarists have performed a valuable literary and historical service, providing a candid, often eloquent record of their times while unburdening themselves to the blessed neutrality of a blank page. In a recent *New York Times* essay, William Safire mused about the impact CD-ROM technology could have on this most intimate of activities.

"You're getting ready for bed. Your computer beeps hello, automatically creates a file for that day, and—to provide a world context for your personal diary—dumps in your newspaper's news summary and the top of the TV news, along with all your electronic mail and recorded phone calls.

"With your handy scanner, you transmit into the computer file any printed articles of interest, or hard-copy letters or valentines you sent or received, and any pictures you took.

"Then you add the personalizer: write what you think about any of this, or recount some amusing or poignant episode that would otherwise be forgotten, or put down some good idea that nobody asked you about. Write to yourself in the future about what moves you in the present.

"You can put away a million bytes a day, encrypted for privacy, and after a lifetime will not have filled up one filing cabinet. But oh, will you have a resource: memories to review, experience to interpret, a whole life to relive."

DRUG DETECTION

SOMETHING'S IN THE AIR

When it comes to identifying substance abuse in the office, do the ends justify the ENDS?

ENDS, a new environmental narcotics-detection service offered by Pinkerton Security & Investigation Services of Van Nuys, Calif., and Thermedics Inc. of Woburn, Mass., is designed to help employers detect illegal drugs in the workplace. The service features an ultra-sensitive drug-detection system capable of identifying trace amounts of narcotics such as cocaine, heroin and methamphetamine. Thermedics' Sentor system uses a hand-held sampling gun to collect air from an item or area; the sample is then introduced into a portable analysis unit, which employs gas chromatography to identify the presence, type and relative strength of narcotic vapors.

Under the ENDS program, Pinkerton guards would use the Thermedics system to test work sites for evidence of illegal drug use. Prices will vary depending upon size of the site and density of sample: A 15,000-square-foot office might start at $5,000.

The program has been drawing fire from the American Civil Liberties Union and others who fear that it may result in unfair dismissals or other disciplinary action. But Pinkerton says such fears are unfounded. The firm expects employers to sign an agreement stating that "they understand this is a non-invasive, non-intrusive service for the workplace, not the workforce, and they won't take action against a specific employee based solely on [the results we obtain]," said Kevin O'Connor, a senior vice president with Pinkerton. "We won't perform the service without [that agree-

ILLUSTRATION ABOVE BY FRAN O'NEILL; BELOW BY JAMES KACZMAN

TRENDLINES

ment]. The information we provide may then cause [employers] to examine the workplace further."

In addition, while Sentor is notable for its ability to detect trace amounts of narcotics, it also indicates how much or how little of a given substance is present, enabling users to distinguish between suspicious quantities of a drug and tiny amounts that might be introduced into an office on paper currency or credit cards, for example.

Despite these promised safeguards, the potential for abuse is still present, according to John Roberts, executive director of the Civil Liberties Union of Massachusetts. "Somewhere along the line there are going to be some employers who are so uptight about drugs that they're not going to hire or promote or whatever based on [trace] findings," said Roberts. "Innocent people are going to get burned the way they've been burned with other kinds of drug testing. It's part of a trend of employers going beyond the ability to do the job and getting into the employee's lifestyle, which is an infringement of their privacy." ■

BET THE REAPER

Software that predicts the chances of a person dying sounds like something only Morticia Addams could love, but one such program is being prescribed to hospitals as a way to improve care and control costs.

With the APACHE III system, (for Acute Physiology, Age and Chronic Health Evaluation), doctors compare the condition of people under critical care against a database containing a representative sample of more than 17,000 patients. Using a prognostic scoring system that incorporates several variables, the system calculates the odds of an individual's survival; doctors then make treatment decisions.

The system was developed from research conducted at George Washington University and is marketed by APACHE Medical Systems Inc. It is designed primarily for use in critical-care units where expensive treatment often does little more than postpone death.

According to APACHE sales representative Sean Seerey, critical care accounts for 30 percent of a hospital's costs and 10 to 15 percent of beds. "Everyone is losing money in this area," he said. "By accurately predicting which patients will benefit from treatment, APACHE III can save money and improve care by helping hospitals better utilize their facilities and allocate resources." ■

ILLUSTRATION BY FRAN O'NEILL

CELLULAR SERVICE

INFORMATION, PLEASE

The cellular telephone industry has provided a new delivery channel for businesses' marketing efforts. In doing so, it is adding value to its own service—and encouraging customers to pay for more air time as well.

Customers of mobile-communications services across the country now have access to a variety of information sources at the touch of a button or two. Mainly these are information "hot lines," providing updates on the news, weather, sports or traffic conditions. Some companies charge for air time on all calls; others charge users for some (emergency road service, stock-market reports) but not others (the user's voice-mail box, State Police, traffic reports).

PacTel Cellular, a Pacific Telesis company, offers perhaps the most comprehensive information-retrieval service for the cellular market. Last November, PacTel customers in San Diego gained access to some 280 local businesses and information providers through a service called STAR INFO. Users log on by pressing *1 + Send, then select from eight one-digit categories. These include traffic reports, roadside assistance, financial news, events, restaurants, business support and child-care or housekeeping services. There is no fee for the service, but users do pay for air time.

What sets STAR INFO apart from most such services is that if, for instance, a user has called for information on seafood restaurants in the area and then wants to make a reservation, he or she can be connected to the restaurant of choice by simply pressing another button without having to hang up and redial.

STAR INFO's appeal for businesses, according to Ron Lee, owner of San Diego-based Applied Response Systems, which created and runs the service, is that it targets a very specific audience: owners and users of cellular telephones (it's not available over land lines).

Of course, at 50 or 60 cents a minute, why bother with reservations? You could just bribe the maitre d' when you get there. ■

WORKING SMARTER

Even in prosperous times, people want to get the most from their existing resources. In lean times such as these, most are under the gun to do so or else. This month, *CIO* debuts a new column, "Working Smart." It is a vehicle for stories about systems that go the extra mile, that deliver added value to the organization. The payoff is often serendipitous, something that was unforeseen by the system's planners. In other cases what is remarkable is the thoroughness with which an organization is able to exploit a system's potential benefits and integrate it into the very fabric of the business.

Such results, we believe, are the fruits of committed people working smarter. If your company has wrested some unanticipated added value from a particular system—something that has had a significant impact on the organization—or if you know of such success stories elsewhere, please let us know so we can share them with our readers. Your example could help others to work smarter too. ■

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No one's debating whether open systems are a good idea, but you'll hear plenty of discussion about what open systems *are*.

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The real goal is to liberate information that's trapped around your company, so more of your people can use it more easily, and to open commu-

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good, but not everyone agrees how to get there.

nications with customers and suppliers, who no doubt planned their systems without thinking about yours.

And of course, you need to accomplish all this without scrapping your existing multivendor investments.

So the paths to open systems will vary, but there's one thing that won't—consistent industry standards. IBM is fully committed to open systems, so we're equally fervent about standards.

We're active on over 1,200 standards initiatives. We're a sponsor of OSF®, a member of X/OPEN™, and we support ISO™, ANSI® and IEEE™, to name a few. And when a new standard holds promise, we support its development.

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Mission: Critical

With the recession putting the squeeze on IS budgets everywhere, CIOs must learn to do more with less—and be able to prove it, too

BY JAMES A. CHAMPY

As companies grapple with a chilling recession, continual layoffs and tepid demand for everything from home mortgages to automobiles, IS activities have come under the microscope, with limited resources being concentrated on overhauling only critical operations. And higher expectations for IS's contribution require broader skills among IS staff.

These are some observations that emerged from CSC Index's fifth annual survey of North American IS executives. Last fall, we, at Index, polled 444 U.S. and Canadian IS executives from companies of at least $250 million in annual revenue (71 percent were over $1 billion). They said their three top challenges for the new year are aligning technology resources with the demands of the business, re-engineering critical business processes, and creating effective technology architectures.

Their budgets will rise a paltry 3.5 percent on average in 1992, extending a trend since 1989 of steadily declining IS budget increases (from a 7.5 percent projected rise for 1989, to 6.9 percent for 1990 to 5.3 percent for last year).

Aligning IS with corporate goals edged out business re-engineering as the greatest challenge. We believe this reflects the pressure on IS executives to ensure that the IT resources of the company—now a major portion of capital budgets—are delivering maximum value. Two-thirds of those polled said they are getting pressure from senior business and/or line executives to justify the value of IT investments.

Re-engineering, the number-one issue in 1990 and '91, is still buzzing through IS and corporate offices. Some 45 percent of the respondents said their companies had a major re-engineering project underway, and of those who don't, two-thirds expect to launch one in the next two years.

Boosting the skills of IS personnel, from managers on down, jumped to fifth place from 13th in 1991. CIOs apparently realize that aligning IS with the business and re-engineering complex processes require a new breed of IS professionals: one that can help executives rethink organizational procedures, not apply technological quick-fixes to ill-defined business problems.

Organizations are getting more selective in what they computerize. Data on where companies will make significant IT investments shows declines in nearly every corner of the organization. Only financial, service-delivery and asset-management activities show a higher percentage of major IT investments.

We believe all this signifies that CIOs are sharply focusing their people and computer investments on high-payback initiatives that will help their companies weather the recessionary storm. Our consulting work suggests a similar trend. We have seen a surge in demand for help in re-engineering inefficient, long-standing business processes so that orders get filled faster and more accurately, new products hit the market faster, customers are served better, and goods and services are produced efficiently and with quality. CIO

James A. Champy is chairman and chief executive officer of CSC Index, an international management-consulting firm.

Top Management Issues of IS Executives for 1992*

	1992	1991	1990	1989	1988
Aligning IS and Corporate Goals	1	2	4	2	1
Re-engineering Business Processes through IT	2	1	1	11	■
Creating an Information Architecture	3	8	9	5	5
Utilizing Data	4	5	7	6	7
Improving the IS Human Resource	5	13	11	8	8
Instituting Cross-Functional Info. Systems	6	3	3	7	■
Improving Software-Development Quality	7	7	14	■	■
Improving Leadership Skills in IS (tie)	7	10	■	■	■
Boosting Software-Development Productivity	8	4	6	13	12
Developing an IS Strategic Plan	9	6	5	4	2
Cutting IS Costs	10	11	10	14	17
Instituting Total Quality Management in IS	11	■	■	■	■
Integrating Information Systems	12	9	16	12	6
Using IS for Competitive Breakthroughs	13	12	8	1	4
Managing Dispersed Systems	14	19	25	16	13

* = SURVEY OF 444 UNITED STATES AND CANADIAN I.S. EXECUTIVES ■ = NOT RANKED THAT YEAR
SOURCE: CSC INDEX, CAMBRIDGE, MASS.

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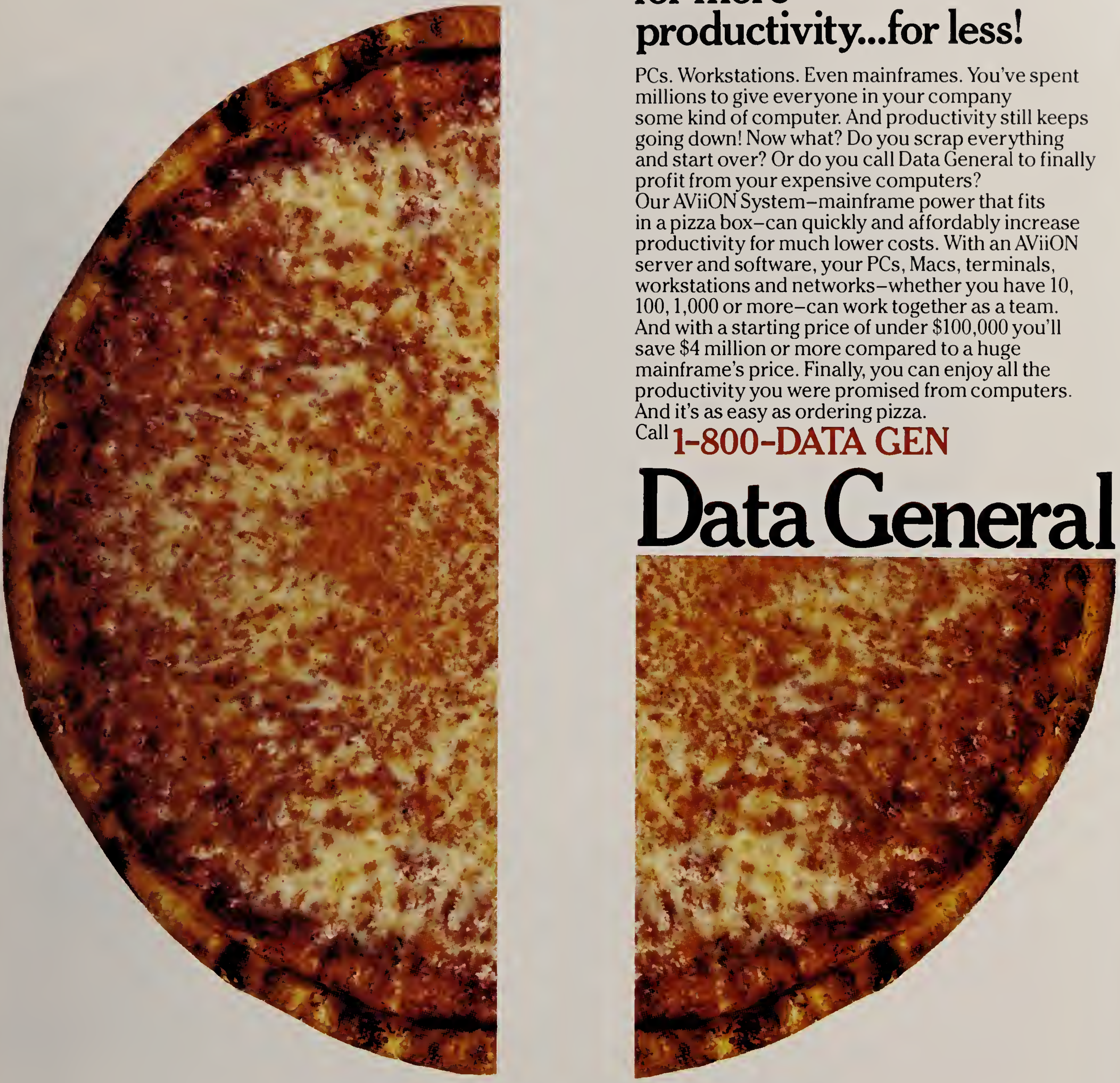

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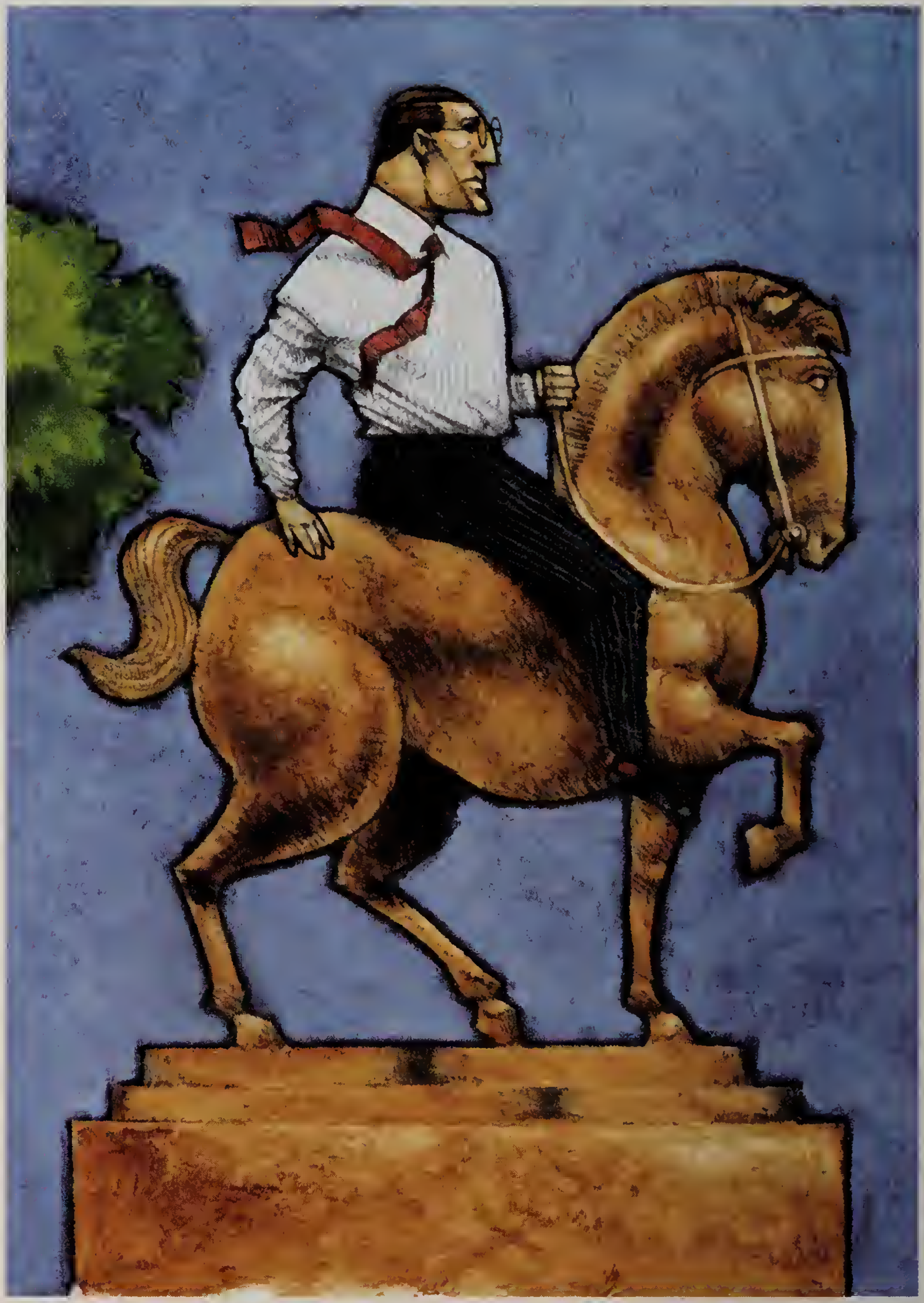
CIOs' most formidable challenge may also be their greatest opportunity: to play a leadership role in helping the company survive and prosper



THE CALL FOR LEADERSHIP

BY DAVID FREEDMAN

CIOs are held in higher esteem than ever before. Many of the complaints that have long dogged them—that they lack strategic vision, for example, or that they aren't meeting key user needs—are heard less and less frequently.

But even as some of these old bugaboos fade, the peers and senior executives who make up the corporate inner circle are presenting CIOs with a more formidable challenge: to play more of a leadership role in applying IT to the organization's benefit. This call for leadership may be the greatest opportunity ever for CIOs—though for now, at least, they seem to be falling short of expectations.

The call for leadership is one issue that emerged from the third annual IS survey of executives sponsored by Coopers & Lybrand and *CIO* magazine. The survey pulled together comments from 201 non-IS executives ranging from CEOs to vice presidents. These managers, whose companies represent a broad sampling of industry and size, responded to a host of questions about the role of IT in their organizations and their perceptions of their CIO (used generically to describe the organization's top IS manager).

As organizations struggle to reinvent themselves in this era of unprecedented competition, executives appear to be looking for a more influential and aggressive CIO to play a lead role in this sometimes painful process. Though more senior managers than ever said that CIOs are basically accomplishing what has been asked of them, many expressed hope that they will go further to weave technology into the corporate fiber.

"It's clear that the CIO is already well into the era of planning, strategizing and managing," noted Ronald Brzezinski, a partner at Coopers & Lybrand's Information Technology Practice and a former CIO of Quaker Foods. "But now there's a crying out among senior management for CIOs to take charge and help the organization find a way out of its problems, even if it means ignoring the more traditional expectations of some managers."

The survey also indicates that not all executives believe their CIO has fully made the transition to senior management; some still urge them to learn the business better and work on communication skills. Executives also made it clear that they don't intend to let CIOs delegate the responsibility of keeping up with technology, no matter how business-oriented the position becomes. Not surprisingly, budget concerns were more prominent in this year's survey. In addition, executives said they are becoming increasingly dissatisfied with having to rely on their gut feel to assess IS effectiveness—though they are still groping for a suitable alternative. And finally, the survey reveals that manufacturing companies, historically laggards in emphasizing IT, continue to fall even further behind (see related story, Page 24).

Clearly, CIOs have continued their ascent into the ranks of senior management. Three-quarters of those surveyed called the CIO a key part of the executive decision-making process; within financial organizations, that number jumped to 91 percent. Ninety percent of respondents said that their CIO is at least somewhat involved in the formulation of overall business strategy and plans, with just over half stating that the CIO is "very" or "extremely" involved, up from 45 percent last year. In addition, 72 percent said that "ideally," the CIO should be very or extremely involved, compared to 62 percent last year. While these are im-

Key Barriers to the CIO's Success

BARRIERS	1991	1990
Budget	24.9%	19.0%
Lack of Peer Understanding	16.9%	20.0%
Lack of End-User Understanding	15.4%	20.0%
Unrealistic Expectations	13.4%	6.0%
Lack of IT Credibility	8.2%	11.5%
No Barriers Exist	6.5%	10.0%
Lack of Business Acumen	5.5%	2.5%
Resistance of Senior Executives	5.0%	6.0%
Other	4.2%	5.0%

ALL CHARTS COOPERS & LYBRAND, 1991

Tight budgets and unrealistic expectations are causing problems for the CIO (the number of respondents citing unrealistic expectations more than doubled from 1990). Users are asking for more help, but less money is available.

ILLUSTRATION BY TED PITTS

pressive figures, Brzezinski noted there's a downside: Most CIOs can no longer use exclusion from the ranks of top management as an excuse for not accomplishing more. "The inner circle is tired of hearing, 'You don't let us in,' " he said. "The CIO is in now, and the rest is up to him."

Of course, the CIO doesn't play a key planning role in every aspect of every organization—but things seem to be headed in that direction. Three-quarters of the respondents said IS is a significant component of business strategy in achieving a competitive advantage, 82 percent said the same of management effectiveness, and 87 percent of improving productivity. Those figures are up about 10 percent over last year. Even more significant, the numbers citing IS influence in facilitating organizational change and restructuring the business shot up to 59 and 78 percent respectively, an increase of almost 20 percent.

CIOs have often been accused of lacking a long-term vision for IS, and of failing to communicate their plan well when they have one. But nearly three-quarters of the respondents said that their organizations had a long-term strategic IS mission, and two-thirds of those executives said the plan was well-understood by the company (see chart, Page 25). Interestingly, only half the respondents from the retail/wholesale industry said their companies had such a plan, but 82 percent of those that did felt the plans were well-understood, possibly suggesting that retail/wholesale organizations have simpler IS plans that only border on the strategic but are easier to communicate.

CIO characteristics considered important have changed a bit in the past year. Respondents ranked strategic vision first, followed by management skills, technical skills, communication skills, business acumen and experience—almost identical to last year's ranking, but with modest drops in the importance assigned to strategic vision and business acumen, and modest jumps in communication and management skills. These shifts were too small to set off any alarms about a de-emphasis of the CIO's role in helping to run the business, but they may reflect executives' feelings that the CIO must run a tight ship and work harder to convey a vision to the rest of the organization.

A Bleaker View

Despite predictions to the contrary, IS still hasn't made much headway in most manufacturing organizations

Manufacturing has long lagged behind other industries—particularly financial-services companies—in embracing information technology as a strategic component of the business. But for years experts have been predicting that the gap would narrow as manufacturers turned to just-in-time inventories, automated factories and a more service-oriented view of their markets.

According to this year's Coopers & Lybrand/*CIO* magazine survey, that hasn't happened. If anything, the gap seems to be widening. "Manufacturing organizations are simply way behind in how they view the importance of information technology," said Ronald Brzezinski, a partner at C&L's Information Technology Practice. "Their CIOs are isolated from the rest of management and have a long, hard hill to climb to get to where their counterparts are in other businesses."

The survey of 201 non-IS executives revealed, for example, that while 76 percent of executives—and a full 91 percent of all the financial-services executives—called the CIO a key part of the executive decision-making process, only 57 percent of manufacturers said the same. When asked about their degree of comfort in interacting with the IS function, over half the executives in other industries said they were "very comfortable," while only 41 percent of the manufacturing executives were. In general, the disparity in these industries' points of view regarding IS was larger in this year's survey than in previous years'.

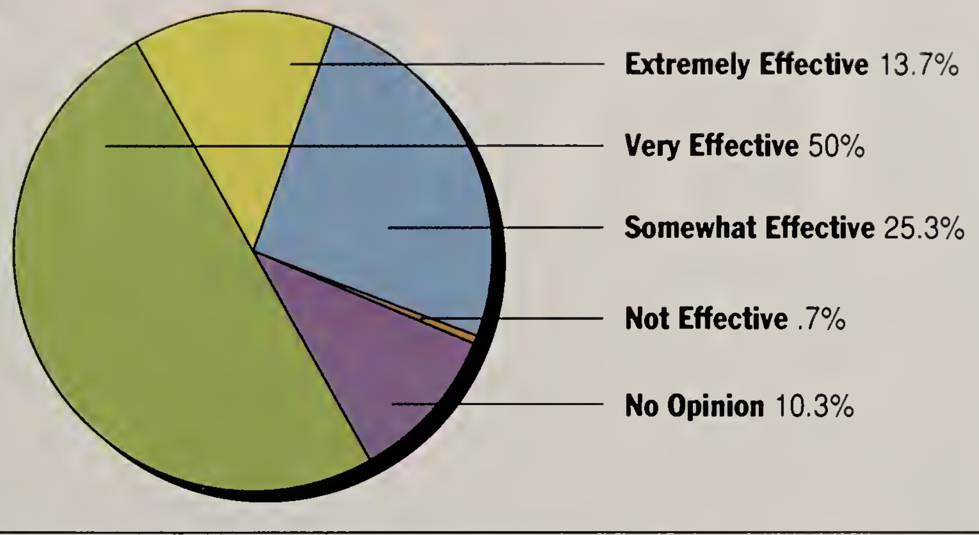
The news for manufacturing CIOs probably won't be much better next year: Only 11 percent of manufacturing executives said CIOs should ideally be involved in formulating business strategies and plans—a much smaller percentage than for all executives.

Of course, it may simply be that manufacturers don't need IT as much as other businesses. After all, Japanese manufacturing companies aren't considered advanced in the application of IT, and look how well they're doing. On the other hand, you'd think that U.S. companies would look for a competitive edge wherever they might possibly find one.

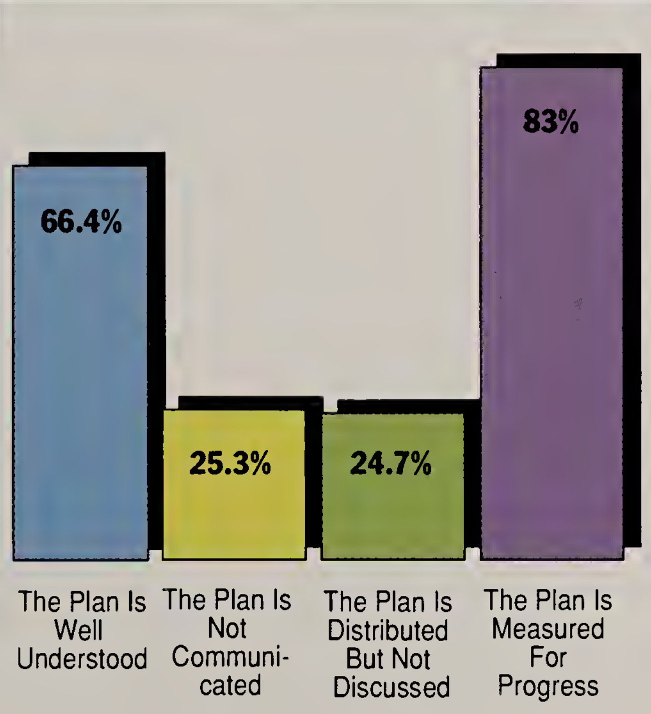
—*D. Freedman*

Three-quarters of those surveyed called the CIO a key part of the executive decision-making process; within financial organizations, that number jumped to 91 percent.

Effectiveness of the CIO at Accomplishing The Plan's Objectives



Effectiveness of IT Plans And Delivery



Nearly three-quarters of those surveyed said their organizations had a long-term strategic mission, and two-thirds of those executives said the plan was well-understood by the company.

"There's a lot of criticism that the CIO is doing whatever he pleases," said Brzezinski. "Executives are urging the CIO to get out and talk to people, especially peers, to convince them that IS is more than technology and to make them allies. To a large extent, CIOs are still islands."

One unmistakable shift occurred in how respondents measure the CIO's effectiveness. In 1990, 60 percent of executives said they employed "gut feeling"; a mere 30 percent said the same this year. Conversely, the most-often-cited yardstick—user satisfaction—came in at 86 percent, only slightly lower than last year. "Measuring is still a problem for executives," said Brzezinski. "They want to evaluate the CIO on a more quantifiable basis, which is why 'gut feeling' has dropped. But user satisfaction can be pretty nebulous, too. It's sort of a where-do-you-stick-the-thermometer situation. If you just had your big system installed yesterday, you'll feel good about the CIO; if your system just got delayed, you'll be critical."

Another striking shift took place in the ranking of barriers to the CIO's success (see table, Page 23). Most of last year's top-ranked problems, including lack of peer and end-user understanding and lack of IT credibility, dropped modestly. But "unrealistic expectations of IT" jumped to 13 percent from a lowly 6 percent last year, while a quarter of all respondents listed "budget constraints" as a key barrier, compared to only 19 percent last year, boosting it from third to first place. IS "has a more difficult time adapting to changing economic environments than do many other departments," noted Brzezinski. "Marketing can cut 33 percent off its budget instantly, but it's hard to lop off more than 7 or 8 percent of the [IS] budget." Difficult economic conditions are also causing executives to think less in terms of major strategic systems and more in terms of straightforward productivity-building and cost-saving efforts, added Brzezinski, explaining the jump in the percentage of executives listing "unrealistic expectations."

While the great majority of executives consider themselves "comfortable" with their relationship with the IS department, more than a quarter said they were either "not very comfortable" or "not at all comfortable" fielding questions about IT. Top-ranking executives in particular, including CEOs, COOs and CFOs, expressed such qualms. "Questions about information technology have recently become one of the 10 most-frequently-asked questions at stockholders' meetings,"

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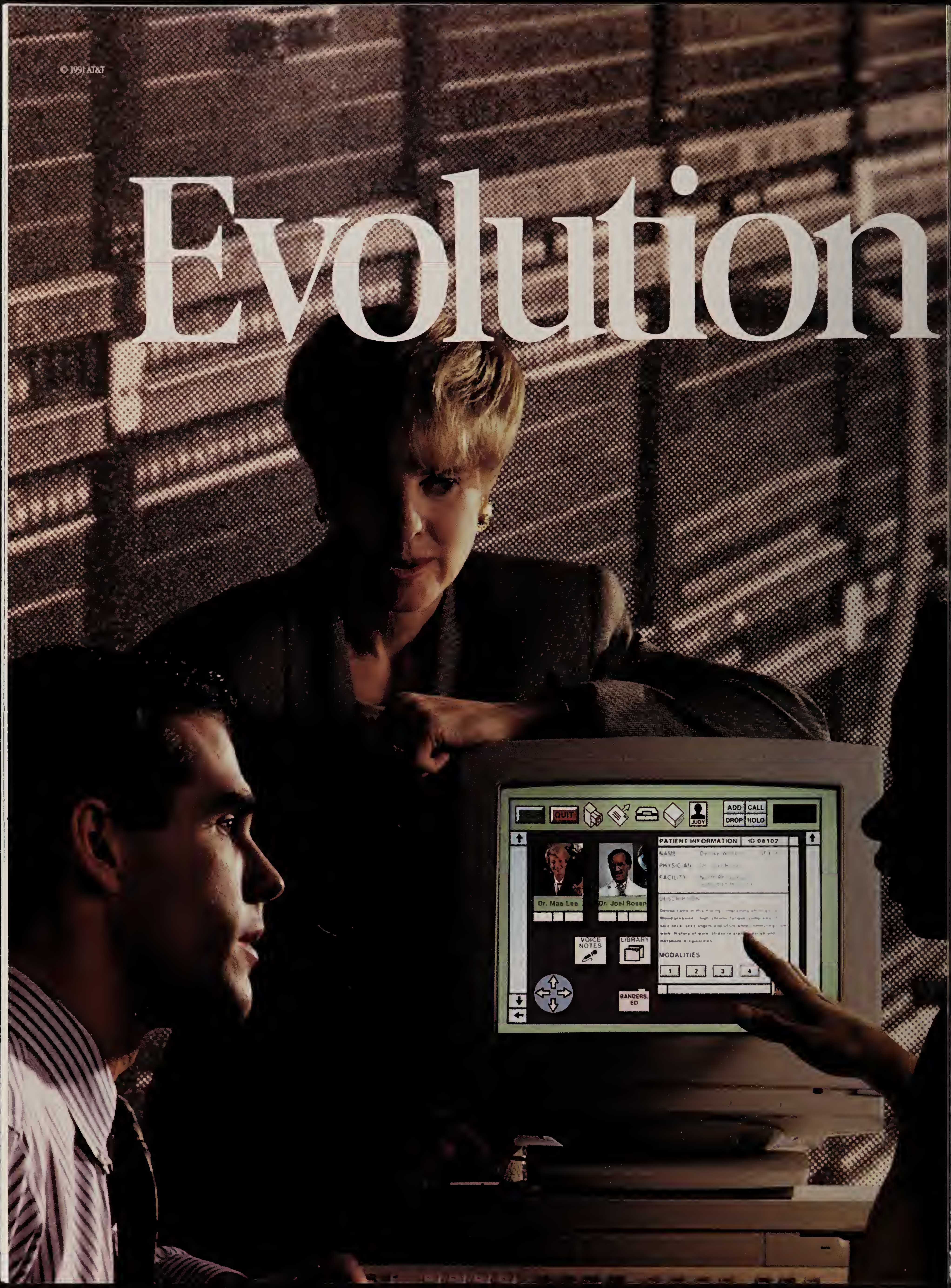
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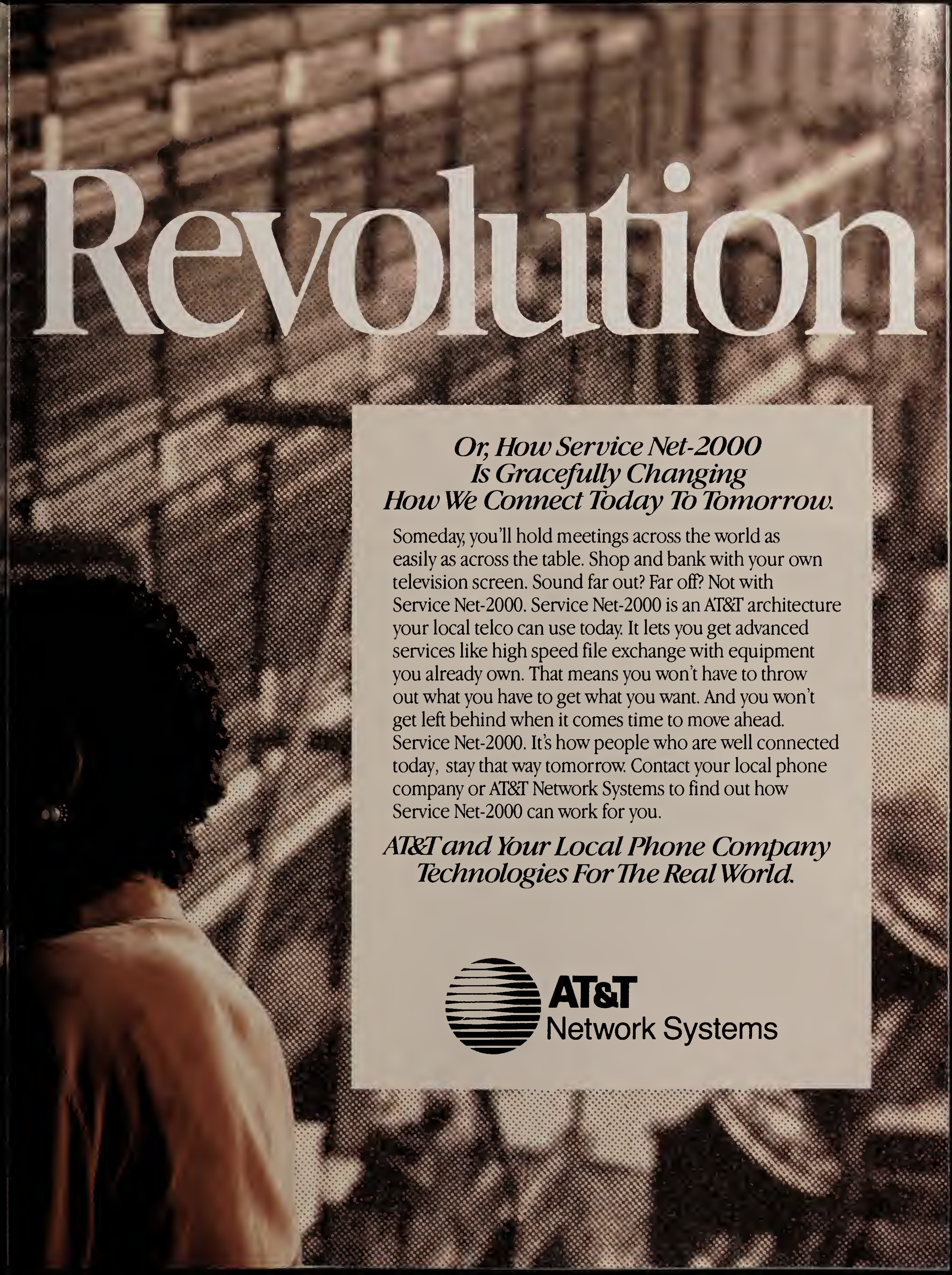

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said Brzezinski. "CEOs have a technology gap, and they're asking the CIO to help them close it."

Organizations' technological reliance on CIOs was further underscored when executives were asked to name the CIO's most important accomplishment over the last two years. Only 18 percent cited a management-related accomplishment, such as providing guidance on IS directions, while 59 percent listed a purely technical accomplishment, such as implementing a new computer or set of applications—a gap 15 percentage points wider than last year.

Some of the most revealing responses came in the free-form answers to the question, "If you could anonymously give your CIO a strong piece of advice, what would you tell him/her?" (See table, below.) Eighty percent weighed in with comments ranging from the laudatory to the brutal. According to Brzezinski, almost 24 percent of the responses could be characterized as "a call for leadership" ("be more proactive;" "educate top management to the market-expanding capabilities of IT"); 22 percent were comments on the CIO's personal skills and style ("don't oversell new technology;" "listen more carefully to everyone in the organization"), and 19 percent offered advice on management issues ("eliminate paperwork;" "watch costs"). Alas, a mere 14 percent fell into the category of total support—though, on the bright side, only 1 percent growled, "Get a new job."

> *"Executives are urging the CIO to get out and talk to people, especially peers, to convince them that IT is more than technology and to make them allies. To a large extent, CIOs are still islands."*
>
> *–Ronald Brzezinski*

What Would You Tell Your CIO — Anonymously?

Leadership Advice 23.5%

- Be more forceful in selling his ideas to upper management.
- The primary responsibility of the CIO is to educate top management, not to the benefits, but to the market-expanding capabilities of IT.

Personal Skills/Style Advice 22.5%

- Pay attention to customers and continually communicate. Establish a quality environment to meet client needs. And *don't be late.*

Management Advice 19.5%

- Make himself more accessible to his people.
- Bring new blood into his department.

No Opinion 19.5%

Total Support 14%

- He's following a plan that makes sense to him and myself. I understand it. He's a realist.

Total Lack of Support 1%

- Change jobs. He's been here doing the same thing for years. Inside is fine; outside is even better. We need a new person who will make changes.

Many respondents actually entreated CIOs to disregard many of the demands on their department, if that's what it takes to set bold new courses that will ultimately benefit the organization.

Brzezinski felt the unusually large percentage of comments urging more leadership was particularly significant. Many respondents actually entreated CIOs to disregard many of the demands on their department, if that's what it takes to set bold new courses that will ultimately benefit the organization. "These executives are saying, 'Don't get caught up in simply reacting to everything people ask you for,' " he said. "They want the CIO to take the lead and separate the fluff from the high-payback. The pressures of the economy are really forcing the CIO to take more responsibility for helping the company to survive."

Ironically, many senior executives seem to believe that IT has little to do with the functioning of the organization: More than a fifth of all the CEOs, COOs and CFOs polled stated that their companies could withstand a computer outage of more than five days without a significant loss of business. Either a lot of CIOs haven't done a great job in bringing the power of IT to bear on their corporations' major problems, or—more likely—some senior executives still just don't get it. CIO

David Freedman is a freelance writer based in Brookline, Mass.

CIO

THE MAGAZINE FOR INFORMATION EXECUTIVES

CONFERENCE SUPPLEMENT
TO CIO MAGAZINE
Coronado, California • March 8–11, 1992

CIO PERSPECTIVES SERIES

The Business of IT: Finding the Payoff

Demonstrating the Value

Measuring the Intangible

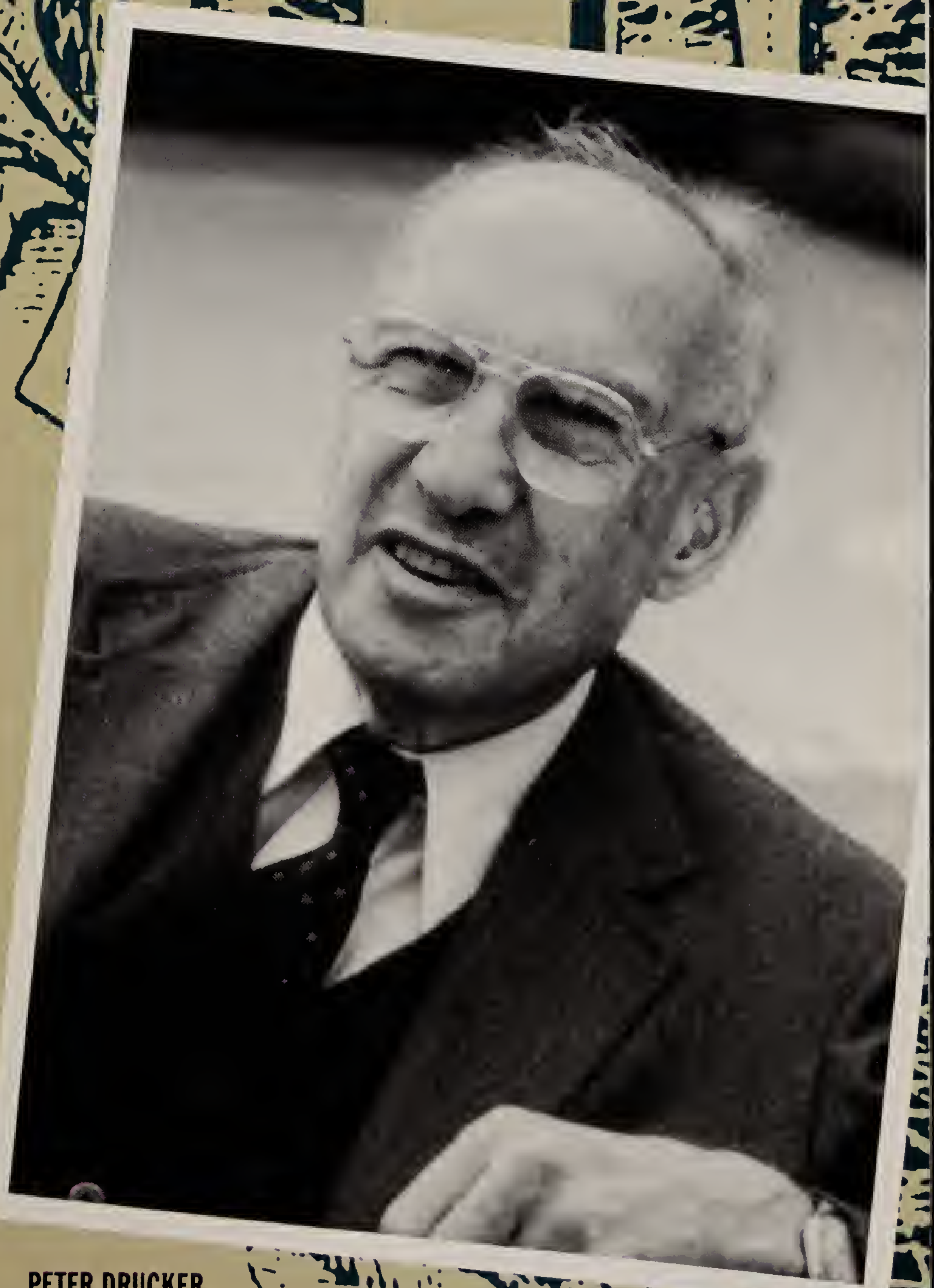
Building Market Share

Competing Transnationally

Achieving World Class Manufacturing

Driving Innovation

A Glimpse of the Future



PETER DRUCKER
"The New Challenges: Information Comes of Age"

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CIO

CONFERENCE SUPPLEMENT

Conference Overview

Joe Levy and Lynda Rosenthal

IT in Business: Let Me Count the Ways

CIOs must develop a way to measure and convey the value of IT to management.

Agenda

Session topics, presenters and scheduled activities are outlined.

Companion Program

Bring your companion! He or she will join you in conference receptions and meals while enjoying a rich variety of San Diego attractions.

San Diego and Coronado Bay

Southern California charms all who visit.

Conference Hosts

Key industry solution providers will show you their newest products and services.

Enrollment Form

Conference Overview

If you are an executive involved in IT management, technology investments, competitive strategies or corporate business, you will want to attend the next *CIO Perspectives* conference, **The Business of IT: Finding the Payoff,** from Sunday, March 8th through Wednesday, March 11th, at the new Loews Coronado Bay near San Diego, California. CIOs, business, financial and other corporate executives involved in or responsible for Information Technology will discuss justifying, measuring and reporting the value of technology investments, and the optimization of their benefits.

Every day, CIOs must pursue the long-term goals of their companies while they are evaluated on fiscal—or shorter—results. CIOs must clearly and tangibly demonstrate the return on IT investments to management and stakeholders; they must choose the targets that offer the biggest payoffs, and discover better processes to convey the merits of IT.

In a variety of formats designed to encourage and stimulate interaction, the country's top technology and business executives will discuss the payoffs in Information Technology.

Our keynote speaker and one of the greatest management thinkers of the century, Professor Peter F. Drucker, will address *The New Challenges: Information Comes of Age,* and join us for a reception immediately following his presentation. Each participant will receive an autographed copy of Professor Drucker's new book, "Managing for the Future," to be published in March.

You can also sample a wide breadth of technology from a select group of innovative, quality technology solution providers.

Plan now to join *CIO,* distinguished speakers in rare public appearances, outstanding technology vendors and your colleagues at the next *CIO Perspectives* conference.

Joe Levy

Joseph L. Levy
President & Publisher
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Lynda Rosenthal

Lynda Rosenthal
Vice President & General Manager
Executive Programs

Information Technology in Business:
Let Me Count the Ways

U.S. business continues to invest heavily in information technology. According to a recent article in *The Economist* magazine, information processing equipment accounted for 51 percent of all the durable equipment bought by private enterprises in 1989. That compares to only 11 percent in 1970.

But what is business getting out of all this technology? Although few would deny that computers have benefited business, exactly how much and in what ways are questions that remain difficult to answer. In these economic hard times, IS professionals are increasingly under the gun to justify large technology investments. It's akin to the philosophical paradox of the tree falling alone in the woods . . . if you can't measure the contribution that IT is making to your business, is the contribution really there?

Most IS professionals agree that there are two ways IT contributes to business success: through tangible (hard) benefits and intangible (soft) ones. Measuring either type of contribution is difficult. But while businesses have some standard ways of trying to measure the hard benefits of IT, the soft benefits are nearly impossible to measure, and it is precisely those benefits that seem to be of highest value today.

In the 1980s, the biggest perceived payoff from information technology was the single application or system that created a crucial competitive advantage for a company. Today some IT gurus argue that such strategic systems are no longer possible. Instead, the big payoff comes from using technology throughout the corporation to make the organization more responsive to its customers and the market.

Max D. Hopper, architect of American Airlines' SABRE system, prompted a lively debate in the *Harvard Business Review* last year when he asserted that the days of using technology to achieve strategic advantage were over forever. Today, information technology is much more pervasive and open, and thus has become a utility, believes Hopper, senior vice president for information systems at American. Proprietary, strategic systems are out, he asserts. "In a competitive world where companies have access to the same data," he says, "the challenge is to excel at turning data into information, and analyzing that information quickly and intelligently enough to generate superior knowledge."

> **"The challenge is to excel at turning data into information, and analyzing that information quickly and intelligently enough to generate superior knowledge."**

Finding the Right Yardstick

In varying degrees, that is what most companies are trying to do with information technology today. But who will do it best and how that effort is measured remains problematic. Hopper's own experience bears witness to that. The latest technology initiative at AMR Corporation, the parent company of American Airlines, is modeled on Hopper's concept of information technology as a utility. The multiyear, $150 million InterAAct system combines data processing, office automation, personal computing and networking. Its goal is to create a technology platform to support all sorts of applications and to bring information to the fingertips of all employees who need it, instantly.

When AMR started the project in 1989, one of its guiding principles was that the project "had to generate hard-dollar savings through productivity gains that are quantifiable in advance, and it should be rolled out in stages to ensure that it is delivering those hard-dollar savings," according to Hopper. The company estimated, based on pilot studies, that automation could produce enough savings to generate a 10 percent return on the InterAAct investment.

But once the actual project started, the company was stymied in its measurement attempts. The pilots had been isolated projects, and it had been easy to identify the effects of InterAAct. But when AMR rolled out the project en masse, identifying the benefits became impossible.

"What we found was that there had indeed been productivity gains, but we were unable to determine if they were solely from InterAAct or some combination of InterAAct and other functions," Hopper admits.

Frustrated in these measurement attempts and constrained by the poor economic state of the airline industry, AMR has changed some of the rules for spending on InterAAct and pushed the responsibility for measurement down to each local department manager. Today, each manager must put the cost of InterAAct into his or her budget and justify it by the savings it is expected to generate within the department. In addition, the manager must justify the cost of new PC purchases by identifying savings that will pay for them within a year.

In InterAAct's case, the payoff is being measured, at least for now, in the hardest of terms: dollars and cents. But there are other, softer benefits that cannot be measured, notes Hopper. One is the added value of quick and easy communication among staff that is brought on by networking and electronic-mail technologies. The other is the cultural change from a hierarchical structure to a team-oriented structure that is facilitated by this technology.

Soft Benefits Hard to Quantify

Such soft benefits can be the most valuable, but they can also be the hardest to quantify. And it is these soft benefits that good businessmen often sense when they make a decision in spite of the lack of hard data.

When making a decision about information technology, executives like to use some kind of financial model, like return on investment or net present value, in order to get a sense of what the costs will be and what type of revenue can be expected. But they often make the decision based not only on numbers, but also on gut instincts, according to James C. Wetherbe, director of the MIS Research Center at the University of Minnesota's Carlson School of Management. "Your really important decisions have to be made with your head, your heart and your gut," he says, adding that a recent survey revealed that 90 percent of executives make most of their decisions based on intuition, but 80 percent of those say they'd never admit to that publicly. "We all like to act like we do everything by the numbers, because it's more professional and analytical," he explains.

"You have to have an understanding of how your business runs, which numbers and analysis don't necessarily tell you."

For example, the decision to make *USA Today* a full color newspaper was as much gut instinct as anything, he notes. Although the technology to do it cost Gannett hundreds of millions of dollars, the executives felt that differentiating their product by making it color would help sell more newspapers. "How can you ever know how many more newspapers they've sold by making it color?" he asks. "You can't."

If IS professionals really want to learn how to cost-justify projects to management, they should talk to the head of marketing, says Wetherbe. Marketing managers know how to work financial models to their advantage. They often sense that a product will be right for the market, but have no hard data to back that up. So they find out what types of financial models the company is using to cost-justify projects; then they project whatever sales forecasts they need in order to justify the product.

The weight carried by hard measurements versus soft instincts will vary from one company to the next. And the way in which the benefit of IT is measured will also depend on the type of business and the extent to which the business depends on technology. At EJV Partners, L.P., for example, "the technology *is* the company," says Steve Ruegnitz, head of the firm's data center operations. EJV is a joint venture of six investment banking companies that is producing an electronic information system called UniView. Through an open, workstation-based technology platform, UniView will deliver financial information, analysis programs and communications among the partners and to customers.

Because the technology is the very heart of the business, the effectiveness of IT is measured by the profitability of the business itself, says Ruegnitz.

Fred Rosen, chairman of the board and CEO at Ticketmaster, a computerized ticket-distribution company, agrees that the only measure of IT that matters is business profitability. But he stresses that his business is more than just the sum of its information technology. The key to success is what the business *does* with the technology. Ticketmaster, which last year acquired its major competitor, Ticketron, succeeded not only because its information system could distribute tickets five to six times faster than Ticketron's, but also because Ticketmaster was a marketing-driven company. Ticketron failed because it was no more than a computer system, says Rosen. "Ticketron saw itself as a utility," he notes. "We see ourselves as a service-driven business that interacts with its customers." In Rosen's view, information systems are nothing more than tools for helping businesses meet the needs of their customers.

Rosen, who characterizes himself as an entrepreneur, not a technologist, thinks that measuring the payoff of information technology may be a pointless exercise because it assumes the wrong perspective. A business needs to look for ways to make money, then use information technology to become efficient in delivering its products and services. "You have to have an understanding of how your business runs, which numbers and analysis don't necessarily tell you," he says. Ticketmaster succeeded by applying a simple formula. "The formula was, if we were leading in technology, then we wanted to stay the leader and keep evolving. We continued to grow our system, to expand its ability to capture more information and to do more functions for the client. And we did it in response to what the customers were asking for."

"Your really important decisions have to be made with your head, your heart and your gut."

This type of responsiveness to customers is being measured at some companies. In the past, IT has been used primarily to increase sales or reduce costs, notes Jack Cooper, vice president and CIO at Joseph E. Seagram & Sons. But the latest trend is to use IT to increase a company's responsiveness and reduce its cycle time, allowing it to react quickly to changes in the marketplace. And that sort of effect can be estimated, measured and quantified, he asserts. For instance, Cooper has used various models to compare current processes to how those processes would flow when technology was applied.

Greater responsiveness provides a soft, but very real, benefit for companies, notes Wetherbe: retaining and gaining customers. Measuring the value of each customer is impossible, and yet that value makes the difference between the success or failure of a business.

No matter how the return on information technology is quantified, the challenge for CIOs is to report these benefits in language management is comfortable with.

CIO PERSPECTIVES

The Business of IT: Finding the Payoff

Loews Coronado Bay, San Diego, California
Sunday, March 8–Wednesday, March 11, 1992

Agenda

Sunday, March 8

2:00pm - 6:00pm	**Conference Registration**
7:00pm - 9:00pm	**Reception**

Monday, March 9

7:00am - 8:00am	**Continental Breakfast**
8:00am - 8:15am	**Welcome & Opening Remarks** JOSEPH L. LEVY *President & Publisher, CIO Publishing, Inc.* CONFERENCE MODERATOR ALAN PALLER *President, AUI Division* *Computer Associates International*
8:15am - 9:00am	**The Return on IS: Measuring the Intangible** JIM WETHERBE *Director, MIS Research Center &* *Professor of MIS, University of Minnesota*
9:05am - 9:55am	**IT's Contribution to America's Competitiveness** LESTER M. ALBERTHAL, JR. *Chairman, President & CEO, EDS*
9:55am - 10:25am	**Coffee Break**
10:25am - 11:10am	**Competing in Transnational Markets** DAVID H. STARR *Vice President & Program Manager, OMNI* *Mastercard International*
11:15am - 12:00pm	**Climbing Mount Everest:** **The CIO's Inclusion in Top Management** ARTHUR P. STERN *President (retired), Magnavox Advanced Products* *& Systems Company; Past President, I.E.E.E.*

Alan Paller

Lester M. Alberthal, Jr.

Arthur P. Stern

Jim Wetherbe

TO ENROLL, CALL 800-366-0246

Fred Rosen

Steve Ruegnitz

Monday, March 9

CONTINUED

12:00pm - 1:30pm	**Luncheon**
1:30pm - 6:30pm	**NETWORKING & AFFINITY GROUPS** Various small group, facilitator-led discussions and recreation
6:30pm - 7:30pm	**Reception** hosted by Texas Instruments
7:30pm - 10:00pm	**Dinner**

Jack Cooper

Lawrence L. Howard

Nigel A. L. Brooks

Jack Livingston

Ray Lane

Patricia M. Wallington

Steve Perkins

Tuesday, March 10

7:15am - 8:15am	**Continental Breakfast**
8:15am - 9:00am	**Driving Innovation & Entrepreneurship through IT** FRED ROSEN *CEO, Ticketmaster*
9:05am - 9:55am	**Getting IT on the CEO's Strategic Agenda** PATRICIA M. WALLINGTON *Vice President & CIO, Information Management, Xerox Corporation*
9:55am - 10:25am	**Coffee Break**
10:25am - 11:10am	**IT's Role in Building Market Share** JACK COOPER *Vice President & CIO, Joseph E. Seagram & Sons*
11:15am - 12:00pm	**The CIO as Senior Business Partner** NIGEL A. L. BROOKS *Vice President, Worldwide Technology Management* *American Express Travel Related Services Company, Inc.*
12:00pm - 1:15pm	**Luncheon**
1:15pm - 2:00pm	**Competitors in Partnership: A Beautiful Relationship?** STEVE RUEGNITZ *Head of Data Center Operations, EJV Partners, L.P.*
2:05pm - 3:00pm	**BREAK OUT SESSIONS**
	The CASE Bill of Rights LAWRENCE L. HOWARD *Vice President, Sales & Marketing* *Advanced Information Management Division, IEF, Texas Instruments*
	No Strings Attached with Mobile Data Communications JACK LIVINGSTON *CIO, National Car Rental System Inc.*
	CIO/Booz Allen & Hamilton 1992 CEO/CIO Survey RAY LANE *Senior Vice President* *Booz Allen & Hamilton* STEVE PERKINS *Vice President* *Information Systems Group* *Booz Allen & Hamilton*

Tuesday, March 10

CONTINUED

BREAK OUT SESSIONS CONTINUED	**Will CIOs Survive in a Distributed World?** FRANK GENS *Vice President, Technology Assessment,* *Technology Investment Strategies Corporation*
3:00pm - 3:30pm	**Coffee Break**
3:30pm - 5:30pm	**The New Challenges: Information Comes of Age** PETER F. DRUCKER *Clarke Professor of Social Science & Management* *Claremont Graduate School*
5:30pm - 6:30pm	**Reception** with Professor Drucker

Wednesday, March 11

7:15am - 8:15am	**Continental Breakfast**
8:15am - 9:00am	**The Myth of IT as a Strategic Weapon** MAX HOPPER *Senior Vice President, Information Systems* *American Airlines*
9:05am - 10:00am	**BREAK OUT SESSIONS**
	A Road Map to Open Systems LAURA CORY *Director, Network Systems Group, Hewlett-Packard*
	PCs: The Payoff Gets Bigger RANJIT SITLANI *Executive Vice President, Tandon Corporation*
	The Challenge of Achieving World Class Manufacturing through IT DR. JONATHAN GOLOVIN *Principal Founder & Chairman of the Board* *Consilium, Inc.*
	Bringing Quality Planning Methods to Senior Management TOM GILB *International Consultant, Lecturer and Author*
10:00am - 10:30am	**Coffee Break**
10:30am - 11:15am	**Strategic Telecommunications Networks: Highway to Profit** JIM NORMAN *President* *Racal-Datacom* ED DALY *Senior Vice President,* *Central Engineering* *Racal-Datacom*
11:15am - 12:00pm	**A Glimpse of the Future: IT Then** PORTIA ISAACSON *President, Dream Machine Inc.*
12:00pm - 12:15pm	Summary

Frank Gens

Max Hopper

Laura Cory

Ranjit Sitlani

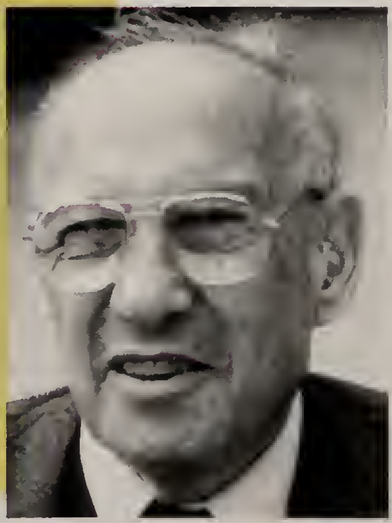
Dr. Jonathan Golovin

Tom Gilb

Jim Norman

Ed Daly

Portia Isaacson


Peter F. Drucker

TO ENROLL, CALL 800-366-0246

Companion Program

This program offers planned activities for companions during the conference sessions. Enrollment in this program is necessary to attend any conference functions or meals.

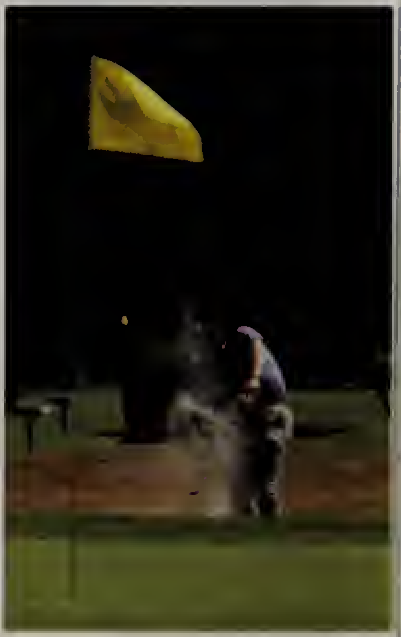
An informal coffee on Monday morning will give companions a chance to meet each other. After lunch with the conference participants, companions will visit Tijuana, San Diego's sister city and gateway to Baja California, the longest peninsula on earth. En route a tour guide will describe Tijuana's unique shopping and entertainment features. The tour will include time for shopping on the Avenida Revolucion, the main shopping area. A reception and dinner with conference participants will complete Monday's scheduled activities.

Tuesday, companions will have a morning driving tour through Balboa Park and a "behind the scenes" tour of the San Diego Zoo. A box lunch will be provided. There will be free time to explore the remainder of Balboa Park, San Diego's geographic and cultural hub. Balboa Park is also home to the Natural History Museum, Museum of Art, Museum of Man, Reuben H. Fleet Space Theater and Science Center, the San Diego Automotive Museum, the House of Champions and the Starlight Bowl. We will return to the hotel in time for Peter Drucker's keynote presentation, followed by a reception with Professor Drucker.

We've extended the Monday afternoon program to include conference attendees, who can sign up for Monday afternoon's activities at an additional fee. Please refer to the enrollment form for details.

Sunday, March 8	
7:00pm - 9:00pm	Arrival Reception
Monday, March 9	
8:30am - 9:30am	Continental Breakfast
12:00pm - 1:30pm	Luncheon
1:30pm - 5:30pm	Tijuana Excursion
6:30pm - 7:45pm	Reception
7:45pm - 10:00pm	Dinner
Tuesday, March 10	
7:30am - 8:30am	Continental Breakfast
9:30am - 3:00pm	San Diego Zoo
	Luncheon
	Balboa Park
5:30pm - 6:30pm	Reception with Professor Drucker
Wednesday, March 11	
7:30am - 8:30am	Continental Breakfast

JERRY TAYLOR/FPG INTERNATIONAL



DAVID McGLYNN/FPG INTERNATIONAL

Southern California

Where can you find 70 miles of Pacific Ocean beach, beautiful bays, towering mountain ranges and striking desert set in a perfect year-round climate on an international border? San Diego is California's second largest city, with an abundance of activities available for visitors.

San Diego's cultural and entertainment attractions offer additional value. The city abounds in museums, galleries and parks. The perfect climate provides outdoor enthusiasts with many options. The area boasts dozens of golf courses, tennis courts and jogging, hiking and biking trails through scenic paths. For the more adventurous, a ballooning expedition over the coastline can be arranged.

North of San Diego is La Jolla, a fascinating city, with the Gaslamp Quarter, Mission Bay, Seaport Village, wineries and Torrey Pines State Reserve.

The America's Cup regatta, international sailing's oldest and most prestigious competition will be held in San Diego this spring. While the finals occur in May, the qualifying trials of the crews and boats that hope to compete in the finals will be taking place in March.

JAMES BLANK/FPG INTERNATIONAL

EARL YOUNG/FPG INTERNATIONAL

Loews Coronado Bay

Coronado Island, across the bridge, is home to the new Loews Coronado Bay hotel, our headquarters hotel. The resort is situated on the private 16-acre peninsula of Crown Isle. Twenty minutes from San Diego airport and fifteen minutes from the Mexican border, the hotel offers a panoramic view of the marina, the Coronado Bay Bridge and the San Diego skyline.

With its 80-slip marina, bayside tennis courts, full service health and fitness facility, private access to the beach and unlimited water sports and recreation, the Loew's Coronado Bay is a sparkling addition to Coronado Island.

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Corporate Hosts

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Booz Allen & Hamilton is an international management and technology consulting firm committed to helping senior executives in the world's foremost corporations and institutions solve difficult problems.

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RACAL-DATACOM

Racal-Datacom is one of the world's leading independent providers of data communications products, systems and services. Racal-Datacom's commitment is to supply a broad range of integrated data communications technology and professional services capabilities that positively impact its customers' business goals. Racal-Datacom is the global union of 15 individual companies in 10 different countries.

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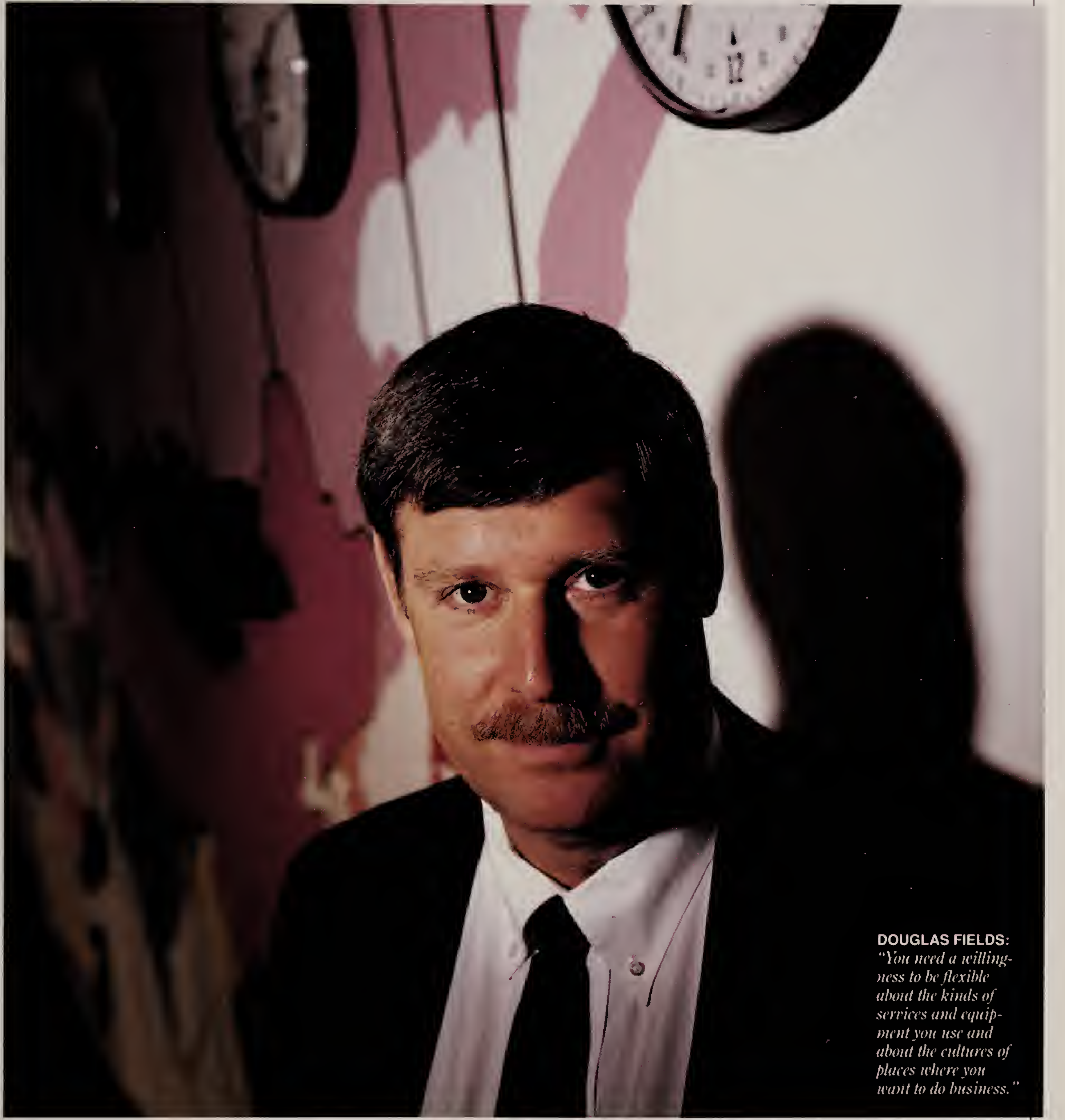
GLOBE TROTTERS

Organizations setting up transnational networks are sure to encounter technical, organizational and political obstacles. But the payoff—improved communication, cohesiveness and the ability to snatch business opportunity from less-well-connected competitors—could be well worth the hassles.

BY MEGHAN O'LEARY

CIOs who have tired of *challenges close to home can find new worlds to explore by extending their telecommunications networks across international boundaries. It is no longer enough to call it networking, or even global networking. "Transnational networking" and "enterprise networking" are the powered, swashbuckling buzzphrases that signal global electronic communications' emergence into the organizational mainstream. Such technically supported empires, once a luxury, are increasingly an operational necessity for businesses looking to create new international markets or hold on to old ones. They are the basic vehicle for companies that rely on cheaper foreign labor or resources for a competitively priced product. They offer the reality of a never-ending business day to paper-trading organizations hemmed in only by time zones. They give a sense of wholeness to diversified parent companies whose subsidiaries and acquisitions are flung far and wide. They offer communication, cohesiveness, opportunity.*

In addition to their numerous benefits, global networks offer daunting challenges. A mind-boggling array of technical standards, unyielding corporate structures, cultural barriers and nonexistent national telecommunications structures are just a few of the problems facing CIOs with dreams of multiplexing internationally. What follow are the stories of a handful who have successfully sidestepped the obstacles, negotiated their way around them or crashed right through.



DOUGLAS FIELDS: *"You need a willingness to be flexible about the kinds of services and equipment you use and about the cultures of places where you want to do business."*

UNITED PARCEL SERVICE

United Parcel Service of Atlanta engages in so much telecommunications activity in Europe that it is considered a PTT (European telecommunications administration). UPS's global network, UPSNet, supports a variety of activities worldwide, from messaging and customer service to package tracking and customs clearing. Four years ago, UPS made a $1.5 billion commitment to expand its operations from 14 to 181 countries by 1993 and is now faced with the considerable task of rapidly extending UPSNet to many countries where telecommunications services are not readily available. UPS's solution has been to focus on its business mission rather than on a vision of a homogeneous network, according to Douglas Fields, vice president of telecommunications for UPS in Mahwah, N.J., and Rino Bergonzi, vice president of information services.

In areas where UPS has acquired an existing company, that company's telecommunications operations have

PHOTO BY JOSEPH BERGER

been added to UPSNet as a new node. In England, the company acquired an air-transport company and opted to use its central location as a European communications hub, striking a high-volume, low-cost deal with British Telecom.

Where expansion has required UPS to create new operations, the company has worked with local and international specialists, rather than hiring a global-communications carrier to secure services around the world. "I didn't have good luck going to people who were global-communications carriers with contacts in a lot of places," Fields said. "They didn't have those contacts as well established as they said." In one case UPS suffered a delay of 18 months waiting for one global-networking company to arrange services.

"We were better off dealing in individual countries by ourselves," Fields explained. He stressed the importance of stating up front the organization's business needs and cost constraints and getting the advice, help and cooperation of all players. In some areas of the world, this has meant working with businesspeople with more political than technical savvy. In India, UPS relied on a U.S. staff member whose family had connections to the telecom minister. The company was able to get permission to lay cable from its office in a Bombay suburb to the city, from which point the company could rely on satellite communications.

In areas of the world where UPS's business operations are scant enough to require only basic telecom service, such as in Moscow, the company has provided just that, relying on common-carrier lines and dial-up packet switching.

"You need to be flexible about the kinds of services and equipment [you use and] about the cultures of places where you want to do business," Fields said. "[Our plan] allowed us to have a variety of structures with the same goal. It didn't say we'd use identical equipment or means of support and installation. It said that whatever we do has to satisfy our business goal." ■

CHIP LOHMAN: *"The Marine Corps' networking begins with the business of conducting warfighting—logistics, manpower, training, intelligence."*

PHOTO BY KATHERINE LAMBERT

UNITED STATES MARINE CORPS

The last networking difficulty anyone would expect from an organization of 200,000 identically clad and coiffed individuals is lack of consensus, but that was the biggest issue the Marine Corps faced in 1989 as its Command and Control, Computers, Communication, Intelligence and Interoperability Division (known as C4I^2) pondered the creation of an enterprisewide network that would connect bases and temporary battlefields across the world. The Corps hoped to improve its communications capability by creating a wide area network that would connect many smaller local area networks as well as the mainframes and minicomputers that provide the bulk of the Marines' data storage.

"The Marine Corps' work in networking begins with the business of conducting warfighting—in other words, logistics, manpower, training and intelligence," explained Major Chip Lohman, the data processing officer who is currently in charge of plans and review within C4I^2. "Those [elements] were in place long before we selected a LAN."

The Marines' approach to keeping up with technology was to decentralize the procurement process, allowing individual sites to buy the equipment they needed. In order to allow each site broad purchasing power, however, the Corps had to get its IS-management officers (ISMOs) to agree on a networking standard, one that would meet the requirements of Marines stationed in the Saudi Arabian desert as well as those in Quantico, Va.

"So the director of C4I^2 said [to the ISMOs], 'You're authorized to hold a conference,' " Lohman said.

"In civilian parlance, we had the CIO telling the mid-level managers to come having done their homework." In four days, the ISMOs had inventoried their requirements, shared their own experiences and conveyed their needs to a consultant, who decided on a Banyan VINES LAN architecture linked to the Corps' IBM SNA mainframe network. Field experience carried as much weight as development expertise at this conference. For instance, one LAN architecture was rejected because the repeaters it relied upon froze at 30 degrees. Other requirements the officers had for the linking architecture were interoperability, survival in dusty environments, the ability of a soldier to train on the same computer he or she takes to war, ease of LAN management, cost of training, the ability to support multiple architectures, and a gentle administrative learning curve.

Although their requirements were varied, the issues each officer raised were understood by all, owing perhaps to the fact that every marine, from pilot to supply officer, goes through the same basic training. "With warfighting [as] the common requirement, it's a very streamlined decision," Lohman pointed out.

In addition to being efficient, Lohman believes that the consensus-building conference produced a solution that might have been overlooked in a more centralized decision-making process. Standardization on a flexible network architecture allowed the designers to focus on the more pressing problems of implementation—for instance, how to lay coaxial cable in the desert.

The resulting network links approximately 640 servers, 20,000 microcomputers, 32 minis and 33 mainframes in the United States, Europe, Japan, the Philippines, Korea and Saudi Arabia. The Marine Corps' network, which received an Enterprise Networking Excellence (ENNE) Award in October 1991, proved to be indispensable in the fast deployment of information, equipment and personnel during the recent war in the Persian Gulf. ■

PHOTO BY JOSEPH BERGER

THE TURNER CORP.

In six years of creating a distributed, global network, building giant Turner Corp. of New York has become expert in deconstruction, moving from a centrally defined, mainframe-based architecture using leased lines, to widely dispersed, globally linked LANs, each controlled by its office or department.

The shift to cooperative processing was not without its problems, however: Turner struggled with controlling and standardizing the early stages of worldwide PC acquisition and getting cooperation from autonomous business units. It worked meticulously to port each application from mainframe to LAN smoothly, providing complete functionality and setting the stage for full integration. The company stresses that every application is mission critical.

"We did the first thing first—we organized," said Dick Schell, director of information systems.

DICK SCHELL: *"Our approach was to provide the functionality that the disciplines would require and then go back to the full integration of it."*

Manager of Information Technology John Good was hired to head up distributed systems, and standards were set for hardware and software. "We put ourselves in cooperation with users rather than fighting them," said Good. "We didn't want to have to make six different operating environments work together."

Although Turner's domestic and international business units treasured their autonomy, they were reluctant to buy into the maintenance and training responsibility of a distributed LAN environment. According to Schell, each office had to have its own troubleshooter, systems engineer, network administrator and training manager, sometimes all in the same person. "Some offices really looked

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forward to it because they had a bigger part of the process," Schell said. "Others didn't want any part of it. They enjoyed just being serviced by the IS crowd." Today, Turner's offices, whether in England or Kuwait, develop applications according to their needs. They merely adhere to the development standards of the company to ensure compatibility. The IS department retains the right to review any project to see if it meets standards.

Turner began rolling out distributed applications companywide in 1986. These new applications were built upon the strengths of the old, but were ultimately more powerful and functional. Gradually, departments became enthusiastic, and managers began to see the payoff of cooperative processing. Still, the IS department insisted on a gradual rollout rather than a one-shot, fully integrated turnover.

"Our approach was to provide the functionality that the disciplines would require and [then] go back to approach the full integration of it," Schell said. The development standards that the company set at the beginning of the process enabled this incremental rollout. "Cooperative processing took a lot of selling in 1985, because people didn't view IS in a cooperative light," he said. "Today we are partnering with all the territories and all the offices."

Enlisting end-user cooperation in moving from mainframes to LANs has paid off for Turner; through the elimination of minicomputers, mainframes and the leased-line network, the company will realize an annual savings of over $1.5 million after 1991. ■

DOW CHEMICAL CO.

Worldwide networking has always created technical management challenges, but in many large companies, the more important implementation issues surrounding a global network are political. Dow Chemical Co., based in Midland, Mich., discovered this almost three years ago when it formed a corporate IS group to oversee the consolidation of its computing resources and creation of a global-network utility.

The company had half-a-dozen data centers in North America, seven in Europe, and several scattered throughout the Pacific Rim. Computing resources are controlled by regional IS groups. The corporate IS group faced the challenge of getting the regional groups to loosen the reins enough to allow it to consolidate equipment and fortify the network with the addition of multiplexers from N.E.T., a maker of advanced communications equipment in Redwood City, Calif., to better suit the company's needs.

"We're a small group that's a coordinating function. We're not telling people what to do," said Henk L. Hazelhoff, the associate consultant responsible for implementing the network. Despite Hazelhoff's clarity on his role, the IS group has often relied on diplomacy and the improved performance of the evolving network to help it manage the process.

"Most users don't generally view the removal of their local computing power very positively," Hazelhoff said, "but if you can demonstrate that they'll get better performance," they're more likely to cooperate.

In order to win cooperation, Dow had to put standards in place and cut across a lot of traditional corporate boundaries. "That took a sales pitch," Hazelhoff admitted. "It's almost like a mind-set shift." The cooperation of regional groups was essential to expanding their network focus from local activities to the companywide mission.

Another concern the regional groups had with the network-utility concept was its cost. The regions were being asked to spend money slated for regional projects on global expansion, and they asked for cost justification of the expenditures. Hazelhoff's group pointed out that the inevitable consolidation would result in many more remote users relying more heavily on the network, increasing the likelihood of a network outage and bringing a halt to business activity. The multiplexer solution would let the network automatically reroute data, saving money and downtime.

In addition, when budgets got tight and the regions were asked to choose between local priorities and the global utility, the network's outstanding performance during consolidation was a big selling point.

"It's very difficult to implement these new technologies if people don't have the proper mind-set," Hazelhoff said. "But I think the biggest thing we have to be concerned about is that people understand why we want to do this. This is an advantage to the company. This is not something we want to do to [gain] control."

"There is a big difference between centralized management and centralized control. We're practicing centralized management and distributed control."

–Henk L. Hazelhoff

Today, with the consolidation about halfway complete, regional IS groups do their own buying, development and troubleshooting. They also have easy network access to a wealth of centralized data, more reliable communications and greater functionality.

"There is a big difference between centralized management and centralized control," Hazelhoff said. "We're [practicing] centralized management and distributed control."

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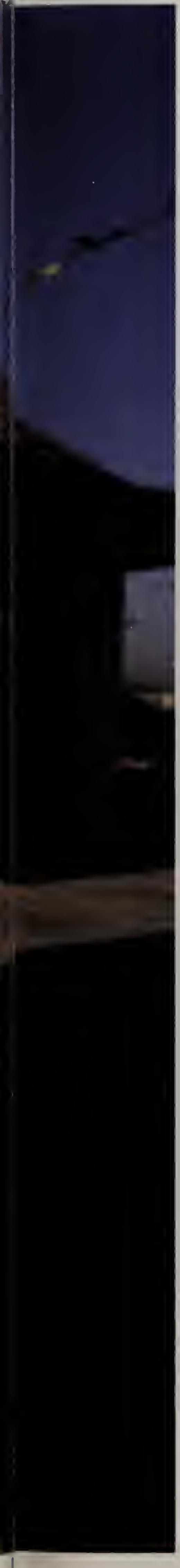
RALPH KIRCHEN: *"IS has the system designed so that as issues come up, we feel comfortable expressing our opinion at any point."*



SURVEYING THE FIELD

IS departments are finding that sophisticated metrics can't compare with getting up close and personal when it comes to appraising performance

BY RICHARD PASTORE

Back when Ed Koch was mayor of New York, he could often be spotted parading with labor unions or gay-rights groups, waving to the curbside crowds and shouting, "How'm I doin'?" A nice folksy way for Koch to appear close to his constituents, but certainly not an accurate, scientific opinion poll. Information systems managers, on the other hand, traditionally have opted for more sophisticated metrics to gauge their performance—uptime, function points and defects per thousand lines of code. They rarely directed a "How'm I doin'?" to IS constituents—the users.

Neither system worked.

When the charm of Koch's rhetorical parade polls wore off, New Yorkers called him out of touch and gave him the boot. Likewise many users, fed up with function points and other obfuscations, are accusing IS of being out of touch with their needs. Now, with threats of outsourcing looming, what CIOs need more than ever is an internal customer-satisfaction measurement program that not only shows how they're doing, but where they must improve.

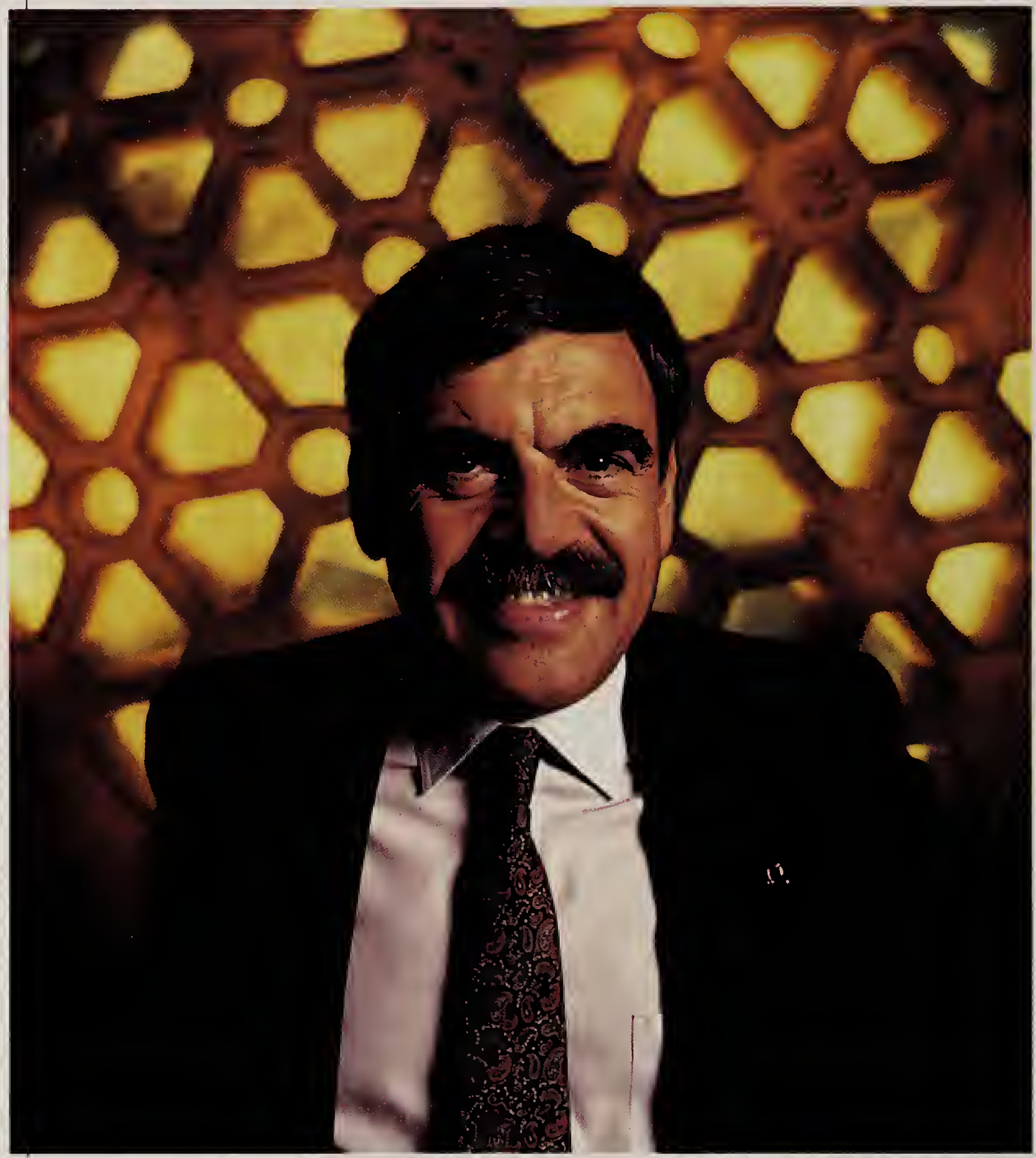
Asking internal customers what's good and what ain't may sound like second nature. But according to the Quality Assurance Institute in Orlando, Fla., only half the Fortune 500 have attempted an internal customer survey, and the percentage is far lower among smaller firms. A familiar anti-survey argument is that the effort is better expended on correcting the problems, not measuring them. "The problem with that reasoning is they're not sure what constitutes customer satisfaction," countered Greg Boone, president of Systems Research Inc., a consulting firm in Issaquah, Wash. "If they don't bother to find out, it's guaranteed they won't be improving the right things."

In fact, IS is aware of less than 50 percent of what's actually bothering its clientele, according to surveys by measurement-consulting firm Mathews & Co. in Stamford, Conn.

Even CIOs admit they have buried their heads in the silicon. "IS was very technically focused and didn't understand the business from the customer perspective," said Harvey Shrednick, vice president of information services at Corning Inc. in Corning, N.Y. "There was no real process in place to measure trends in customer satisfaction."

"We always measured ourselves quantitatively, but we weren't going back to the business and asking the customer to

PHOTO BY EUGENE MOPSIK



HARVEY SHREDNICK: *"Employees have more insight into customer concerns than ever before."*

rate us," said Ronald Claude, director of management systems at $2.3 billion label and adhesive maker Avery Dennison, headquartered in Pasadena, Calif.

Companies that have adopted satisfaction programs in the past few years are already reaping benefits. Though Corning's two-year-old program is still being fine-tuned, Shrednick said his employees have "more insight into customer concerns than they ever had before." In response to survey complaints about application-delivery delays, Corning "put together an improvement team to look at the development processes and how we could close the time gap," he said. Users rewarded the successful effort in subsequent surveys, raising their rating for expectations met from 60 percent to 85 percent.

At Atochem North America Inc., a $1.5 billion Philadelphia-based chemicals company, a yearly survey revealed that customers weren't getting reports when they most needed them—first thing in the morning. IS responded by changing the report run schedule. When customers complained they didn't know who to call with a problem, IS set up a help desk.

Over time, effective client-satisfaction surveys can change user attitudes 180 degrees. "I think we are heard. I feel pretty good about the level of interaction," said Connie Albanese, manager of marketing and distribution at Avery Dennison's Painesville, Ohio, site. "I didn't always feel that way," she noted, referring to the bad old days before periodic satisfaction surveys were instituted two years ago.

While consultants caution against conducting surveys solely to make IS look good, there is no harm in boasting when results come up roses. Crowing over positive results "is in the IS director's best interest," said Vaughan Merlyn, partner at Ernst & Young's Center for Information Technology and Strategy in Boston. It's a way to show a job well done without using obscure internal measures to prove it.

Anatomy of a Survey

Ask and ye shall receive—but only if you ask the right people the right questions

The written survey is one of the most popular tools for measuring customer satisfaction. The following are some basic points to consider in designing and implementing a written measurement program.

Whom to survey: There may be three or four layers of internal customers within an organization, and each will have a different opinion of IS. While end users tend to be the most satisfied, business-unit directors are often the most critical because they labor under tense performance and budgetary pressure, consultants noted. IS must decide which are its most important clients within these layers and survey accordingly.

"We survey two levels—the worker bees and the high-level people who chart the direction of the business," said Robert Rubin, vice president of information services at Atochem North America Inc. in Philadelphia. "We do very little with intermediate managers, because they make fewer decisions."

How many to ask: Only a sampling from each targeted customer category need be polled. Atochem surveys two or three people from each

PHOTO BY FOREST McMULLIN

operating group, roughly four percent of all users. Grumman Data Systems in Bethpage, N.Y., samples about 5 percent of its user base.

Response rates—the number of surveys returned—range as high as 90 percent at some firms. Be wary of response rates of less than 50 percent—the results may be skewed toward users who love to gripe or those who are very satisfied. A 45 to 65 percent return is typical for surveys designed by Stamford, Conn., consultancy Mathews & Co. Response rates may be higher if a note from a senior executive accompanies the survey, suggested Mathews President Richard Mathews.

How often to poll: Large, all-encompassing surveys that take over an hour to fill out should only be attempted once a year, IS managers agreed. Smaller or more narrowly focused polls can be repeated as often as quarterly. More frequent communication can come in the form of periodic "update" memos or meetings with customer managers.

What to ask: The survey is only as good as the questions, and the questions are generally awful—at least the first time around. IS has a natural penchant for phrasing queries only IS employees could comprehend. "We had to change some of the questions because we were asking them in our terms, not the customers'," said Steve Bach, director of the data systems division at Grumman. Grumman caught its error while trial testing the survey on 15 customers in Bethpage. Pretesting is an obligatory step that reduces the chances of a new survey falling flat on its face.

Corning Inc. in Corning, N.Y., went right to the source for its survey questions. "We interviewed 150 customers across the company and asked what's important to them and what we should be measuring over time," said Almont Venette, Corning's manager of IS quality.

IS must also overcome another tendency—reluctance to ask the tough questions. "Too often questions are designed with a special answer in mind to make somebody look good," said Ralph Kirchen, a zone vice president of operations and IS customer at Taco Bell in Marlton, N.J. "People on the MIS side have to want the real answer, not something that will just make them feel good."

Picking a rating scale: While most written surveys include multiple-choice and essay questions, rating scales are also popular with both pollsters and polled. Corning originally tried a scale of colors (red indicating dissatisfaction, etc.), but customer preference prompted a switch to a numeric scale. To capitalize on familiarity, Atochem uses the same number scale for surveys as the company uses for employee-performance reviews.

Consultants caution that it is important for scales to include a choice for "don't know" or "not applicable" to ensure accuracy. "Otherwise, it's well known that people will answer a question even if they don't understand it or don't have the data," said Greg Boone, president of Systems Research Inc., a consulting firm in Issaquah, Wash.

Analyzing and taking corrective action: It is all too easy and common to collect the completed surveys, look them over, say, "ah-ha," and, "um-hmm," and file them away in a drawer for all eternity. Indeed, Corning's Venette said the hardest part of the process is "making sure we go beyond reporting and reviewing to actually take action to alleviate any problems."

One quick and accurate way to identify improvement areas is to calculate a mean overall satisfaction score from the completed questionnaires. If the mean is 3.5, then any specific topic rated below 3.5 should be singled out for action. Then it's a matter of prioritizing the problems based on number of users affected and those users' relative importance to the business. IS improvement teams take it from there.

Providing feedback: When it comes to feedback, IS must look at itself as a business within a business and be aware of its own public relations, said Howard Rubin, president of measurement consulting firm Howard Rubin Associates Inc., in Pound Ridge, N.Y. If IS fails to acknowledge and act on customer critiques, it will only seed resentment among users. Post-survey feedback should include acknowledgment of the survey's receipt, a synopsis of both positive and negative responses, and a timetable for corrective action.

Even a simple thank-you goes a long way with customers, as it did at adhesive manufacturer Avery Dennison in Painesville, Ohio. Said Marketing and Distribution Manager Connie Albanese, "I most appreciated the first thing we got back: a thank-you note acknowledging that the survey was received and that results would be forthcoming."

—*R. Pastore*

Inaugurating any satisfaction-measurement program is bedeviled by tough decisions and a little bit of fear. CIOs who've run the gauntlet say the worst comes early. "The hardest part is taking all the motherhood-and-apple-pie statements about getting close to the customer and translating them into specific actions that get you there," said Robert Rubin, vice president of information services at Atochem. Survey launches are complicated by the dread factor—IS's anticipation of a severe customer flogging. "It's a risk for people," Rubin said. "We're human beings like everybody else."

Corning's Shrednick acknowledges the fear but rationalizes it away. "It's better for me to show those [critical] results to my superior than for him to hear it first from someone else," he said. "I'd rather be the bearer of bad tidings and at the same time show how we're going to work to correct it."

The written survey is probably the cheapest and most popular satisfaction gauge. But it takes time to design a questionnaire and analyze

ROBERT RUBIN: *"It's a risk for people. We're human beings like everybody else."*

the results (see related story, Page 52). The entire cycle consumes a full year at Grumman Data Systems in Bethpage, N.Y. Atochem has spent three months analyzing results and another six months implementing corrective action. Outside agents such as Mathews' firm spend four to six months designing a survey and reporting its results—for a fee of from $50 to $100 per person surveyed.

Of the alternative survey instruments, one of the most accurate—and most pricey—is the focus group. Unlike questionnaires that may not always elicit complete or honest answers, the focus group's trained hired facilitator can usually draw out honest opinions, noted William Perry, executive director of the Quality Assurance Institute.

An increasingly popular method for understanding client needs is to temporarily post IS personnel within user departments. The hope here is that IS staff members will absorb firsthand knowledge of customers' day-to-day business and thus better understand their systems needs. Atochem does something of the reverse, inviting business-unit chiefs to speak at monthly IS luncheons. "The only rule is the division presidents have to talk about their problems, not IS," Rubin said.

A less formal approach is a continuously open online channel between IS and its patrons. Taco Bell's version is an electronic-mail network that links users scattered among 2,000 restaurants and 10 district offices. "They have the system designed so that as issues come up, we feel comfortable expressing our opinion at any point," said Northeast Zone Vice President of Operations Ralph Kirchen. "And if something's not working, IS hears about it real fast."

When a company finds a suitable, successful survey instrument, internal metrics often decline in importance. Taco Bell still tracks uptime and average response time, "but the organization doesn't place a lot of stock in that," said Ken Harris, vice president of operations services at Taco Bell headquarters in Irvine, Calif. "It's the same as for a baseball pitcher: Earned run average is not as important as how many games you win."

Atochem too has downplayed its technical measures. For tracking system response time, the subsecond is out and a customer scale of 1 to 4 is in. End users enter their rating daily in an online poll that pops up on-screen just before they log off for the day. "If somebody wants to complain, it's right there," Rubin said. "We still keep internal stats, but now we have a [customer-based] benchmark."

What's next for companies that have mastered internal-satisfaction surveys? Find out what the external customer is thinking. In the past, external customers couldn't give a hoot about a company's system response time or PC support. But that has changed as IS's direct influence on the outside world has increased. When airline systems falter, planes are late. If the system snags at a just-in-time manufacturer, client orders don't get filled. If EDI links go down, suppliers and buyers can't do business.

In the main, IS has been content to tag along with sales or marketing staff on external customer fact-finding missions. Corning, however, is at a point where direct IS-clientele meetings are warranted. "We're having a lot more meetings with [external] customers to understand their requirements and the kind of information they need," Shrednick said. So far, the face-to-face meetings have helped shape programs linking Corning to its industrial buyers. These systems include an EDI hookup to allow buyers to input orders directly into Corning's system and a voice-activated telephone program that reports order status 24 hours a day.

External surveys may even spill over into the consumer market as well. The day may soon come when home pizza deliveries will show up with a card asking diners to grade the response time of the restaurant's PC-based delivery system. "Buon giorno! How'm I doin'?"

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MAKING THE GRADE

The benefits of sponsoring university IS research flow both ways. Sponsors get valuable input into their IS operations, and the universities get crucial exposure to real-world concerns.

BY ARIELLE EMMETT

Information systems is the Eliza Doolittle of emerging academic disciplines. At least that's James C. Wetherbe's contention. IS is upwardly mobile, the flower girl in search of a highbrow accent, a foundling child of business schools that have barely gained respectability themselves.

"There have been a lot of vocational DP schools in the past that have been pooh-poohed as not having any intellectual or academic respectability at all," said Wetherbe, professor and director of America's first MIS research center, at the University of Minnesota's Carlson School of Management in Minneapolis. But IS is a new social butterfly, he suggests. It hangs on the coattails of business schools and follows their uneasy evolution up from a trade-school past.

Today, in fact, IS and business have formed new partnerships with academia. How effective these are depends on point of view; both academics and businesspeople say they are essential if IS is to find a long-term, objective perspective of itself in the midst of startling change.

Like the brash Ms. Doolittle, information systems education has already sought out the academic equivalent of Henry Higgins—in the form of inclusion in prestigious business-school curricula and ponderously titled research projects, and in the establishment over the last two decades of 25 independent, corporate-sponsored IS research centers on campuses around the country.

JAMES WETHERBE: *IS faculty may have too much stake in academic respectability and not enough in the IS practice.*

PHOTO BY STEVE NIEDORF

The centers themselves are a phenomenon, sprouting up in large numbers throughout the '80s and serving as executive forums and hunting grounds for new research ideas. Some academics liken the centers to social-science laboratories that invite the direct participation—and monied support—of both domestic and multinational corporations. Topics may range from comparative surveys of management expectations for the deployment of a particular technology, to investigations of IS productivity, organizational linkage, computers as coordination technology and the impact of IT on functional lines of business.

Most essentially, though, the research pertains to "all the things that help get systems developed faster," according to Wetherbe. "Real research would include trying to un-

EILEEN TRAUTH: *"CIOs say, 'We want problem-solving skills from IS graduates,' and recruiters are asking, 'Do you know programming in Cobol?'"*

derstand what presentations of information allow decision-makers to make better decisions. We might also try to find out what types of quality-assurance procedures reduce errors in systems development."

"The research is sometimes troublesome, sometimes profitable," observed Roger Samuel, a program manager at MIT's Sloan School of Management in Cambridge, Mass., which has hosted some of the largest IS research projects in the country. "But businesspeople up to their necks in alligators don't have time to do any reflective gathering of data." Indeed, many research directors say that IS centers provide a "far from the madding crowd" atmosphere that allows working managers to get some distance from their organizational headaches. It's a view that IS-center sponsors affirm.

"We're interested in [an IS-research center] because there's a lot more to providing IS support than just the hard technical skills involved," said William T. Malin, a Baltimore-based partner at IS management consultancy Ernst & Young, which is an active sponsor of the David D. Lattanze Center for Executive Studies in Information Systems at Loyola College in Baltimore. "We're interested in the management and executive aspects of IS."

Like others, Malin suggests that the center offers a more intimate, coffee-klatch environment where "working managers can meet and exchange ideas." Active speaker and seminar schedules allow companies to share the cost of supporting "stellar" speakers like James Martin. And many businesses use the centers to help management get continuing technology updates rather than hire expensive trainers or consultants.

Among universities these days, there is a definite difference between the expectations and hopes of companies sponsoring large, multinational efforts at centers such as MIT's Center for Information Systems Research (CISR) and the University of Minnesota's MIS Research

PHOTO BY MARK ALCAREZ

Center and those of companies contributing to smaller regional programs.

"Most [IS centers] don't achieve enough of a funding base to generate a lot of sponsored research," said Robert Benjamin, principal of Robert Benjamin Consultants in Rochester, N.Y., and a former Xerox strategist who holds a part-time research appointment at MIT's CISR. "And when a [sponsoring] company spends around $20,000 to $30,000 a year, it doesn't have much of a ferocious instinct about what it'll get out of it." Most programs, in fact, are relatively inexpensive to get involved in, with sponsorship fees ranging from $7,500 to $35,000. Only the most ambitious, such as MIT's "Management in the 1990s" project, require a more substantial commitment (see related story).

A Vested Interest

Companies funding IS research projects should protect their investments

MIT's now well-known "Management in the 1990s" program, a five-year, $5.6 million collaborative research project, enjoyed the support of 12 major U.S. and foreign corporations as well as government groups between 1984 and 1989. The research agenda—a set of more than 30 topics—set out to determine nothing less than "how information technology was going to change the way management was performed during the decade of the 1990s," according to Robert Benjamin, principal of Robert Benjamin Consultants in Rochester, N.Y., and a former Xerox strategist who holds a part-time research appointment at MIT's Center for Information Systems Research, in Cambridge, Mass. "The project tended to be very successful. With each of the companies spending over $100,000 per year for five years, [most had] an intense interest that they get something out of it."

Arthur Young (now Ernst & Young), for example, hoped to gain a competitive advantage in the marketplace. "We knew it was going to be valuable research," said John Sifonis, then national director for information technology at Arthur Young and now a New York-based vice president at Temple, Barker & Sloane. "[And] we knew the association with MIT would have a [special] cachet with clients, a heightened leverage. Being affiliated with MIT made a big difference."

Sifonis spent an estimated 2,000 hours on the project, helping to modify several research-project ideas (including computer-aided software engineering and computer-integrated manufacturing projects), guiding researchers through the organizational maze of client sites and assisting researchers in the analysis of results. "Their objective was to gain knowledge; my objective was to gain new products and services," he said. "Over a five-year period, [the research] probably helped us bring in several million dollars' worth of projects. If you really wanted to be successful, you had to get involved."

Not everyone did, of course. Some of the sponsors maintained a surprising distance from the activities, rotating representatives to each of the five or six project meetings held each year. "The reps were spending half of each meeting just understanding what was going on," Sifonis said. "There was no continuity. The companies that didn't get involved simply didn't feel they got value from the project."

–A. Emmett

Finding the right chemistry between center sponsors and IS scholars is critical to success or failure. According to John F. Rockart, director of the CISR, "inappropriate" sponsors are looking for quick fixes—consulting help thinly disguised—or may be uncertain how to extract benefits from research. Appropriate sponsors, on the other hand, are "people who are really interested in the world around them—who want to think deeply about how information technology is affecting their organizations now and in the future."

Some businesses may be interested in more than that. They seek, directly or indirectly, to influence IS graduate and undergraduate curricula. "It's hard [for businesses] not to have opinions if they're hiring graduates out of your program," noted Dennis G. Severance, Arthur Andersen professor of computers and information systems at the University of Michigan School of Business Administration in Ann Arbor. "We'll not infrequently get somebody who'll tell us that the person we graduated could have been more productive

> *"The research is sometimes troublesome, sometimes profitable. But businesspeople up to their necks in alligators don't have time to do any reflective gathering of data."*
>
> *–Roger Samuel*

if they knew dBase III or some fourth generation language. However, we don't really incorporate those criticisms. Our courses have a theoretical overview, and the tools are secondary."

University of Minnesota's Wetherbe worries that the curriculum may in fact be too detached from the business world. He argues that university IS faculty may have too much stake in academic respectability and not enough in the IS practice. "I worry about this enormous pressure to be respectable," Wetherbe said. He contends that IS is following lockstep in the tradition of business schools, which for decades have patterned themselves heavily after liberal arts—"of being scholarly for the sake of being scholarly," with heavy research agendas.

"Historically, liberal-arts colleges have been established in nice little sleepy towns, where being learned for the sake of being learned was [the goal]. Well, that's different from hitting the streets and going to work in a postindustrial society, where skills like project management and accounting are important."

Wetherbe wonders if there isn't a strong temptation today to work on and teach "toy problems" that appeal to academics instead of relevant, far-reaching research that IS practitioners really need. "You're under pressure to do things relevant to the industry people who want to support and hire your graduates, and at the same time you're under pressure to establish yourself as an academic discipline," he said. "It's a double bind."

Many academics agree. "There's a lot of concern from deans [in some schools] that information systems is a technology thing, not a business-oriented thing," said an IS professor and director of a leading Southern MIS research center who asked not to be identified. "They look down on it, and they're probably right."

One problem that arises is a major disagreement over what should be taught. "There's a gap between what practitioners say they want and what's being taught today," affirmed Eileen Trauth, associate professor of management information systems at the College of Business Administration at Northeastern University in Boston, and project leader of a recent New England study assessing management expectations and knowledge requirements for IS graduates.

CHARLES ANGELINO: *"Schools are not paying enough attention to developments in technology."*

PHOTO BY KATHERINE LAMBERT

"We're getting a lot of mixed messages from industry," Trauth observed. "CIOs say, 'We want problem-solving skills from IS graduates,' and recruiters are asking, 'Do you know programming in Cobol?'" The origin of the problem, according to Trauth, is that management information systems—and the skills they require—are changing rapidly, as are career paths for the future.

"Schools are trying to educate for career paths that are going away," she said. "Right now, for example, things like Cobol and traditional system life-cycle skills are important [for graduates to know]. In the future, however, there will be a very strong emphasis on telecommunications, networks and systems integration—in short, a strong emphasis on integrating and analyzing business problems."

Charles Angelino, a vice president of information systems at the Maryland Casualty Co. in Baltimore, agrees strongly with Trauth. "Graduate programs are still too technically oriented, and they're technically oriented in the wrong areas," he said. "Schools are not paying enough attention to newer developments in technology. They're still back in the second generation, and they're teaching skills that are for the most part not transferable to the business community."

Angelino, who is affiliated with Loyola's David D. Lattanze Center, said he is looking for graduates who can "analyze systems needs and, in con-

Those IT-Covered Halls

An increasing number of colleges and universities support IS research programs funded by corporate sponsors. These are some of the more prominent.

NAME AND SCHOOL AFFILIATION	CORPORATE SPONSORS	ANNUAL SPONSORSHIP FEES	MAJOR PROJECT INTEREST AREAS
David D. Lattanze Center for Executive Studies in Information Systems **The Joseph A. Sellinger, S.J., School of Business & Management** **Loyola College, Baltimore**	23 sponsors, including Ernst & Young, Maryland Casualty and McCormick & Co.	$5,000	Quality in the IS function; human-computer interface; determining value of IS. Supports research by Loyola and other universities
Management Information Systems Research Center **Carlson School of Management** **University of Minnesota, Minneapolis**	25 sponsors, including 3M, MCI and Honeywell	$7,500	Minnesota Managerial Graphics Project; use of IT for competitive advantage in new ventures; systems analysis & design; group decision-support systems
Center for Information Systems Research **Sloan School of Management** **MIT, Cambridge, Mass.**	25 sponsors, including Xerox, Dupont and Proctor & Gamble	$35,000	Improving systems delivery; management-support systems; management of data; coordination processes (including groupware)
Center for Research on Information Systems **Stern School of Business** **New York University, New York**	15 to 20 sponsors, including Citicorp, IBM and Dun & Bradstreet	$10,000	Interdisciplinary research; database systems; AI; system assessment; impact of IS on organizations; groupware
Cognitive Science & Machine Intelligence Lab **School of Business Administration** **University of Michigan, Ann Arbor**	4 sponsors: Arthur Andersen, Steelcase, Apple Computer and Ameritech	No annual fee; project fees vary	Human-computer interaction; collaboration technology
Management of Information Systems Center **College of Business & Public Administration** **University of Arizona, Tucson**	Sponsors include IBM, Hewlett-Packard and AIRMICS	Sponsorship fees vary	Group-support systems; heterogeneous database; multimedia; expert systems
Center for Information Systems Management **Graduate School of Business** **University of Texas, Austin**	20 sponsors, including NCR/AT&T, Texaco and Shell	$5,000 minimum	Organizational computing; decision-support systems; AI
Information Systems Research Program **The John E. Anderson Graduate School of Management** **University of California, Los Angeles**	25 sponsors, including Atlantic Richfield, Security Pacific Automation and 20th Century Fox Film	$3,000 to $5,000	Information systems for organizational innovation; computer-supported cooperative work; applications software maintenance
Center for Information Technology Research **Public Policy Research Organization** **University of California, Irvine**	5 grants, mainly from such organizations as the National Science Foundation and the University of Calif. Pacific Rim program	No annual fee; grants for projects only	Diffusion of IT; computerization and the workplace; IT policy
End-User Computing Research Center **Terry College of Business** **University of Georgia, Athens**	25 sponsors, including IBM, Georgia-Pacific and Coca-Cola	Sponsorship fees vary	Executive information systems; collaborative work-support systems

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junction with business managers, make some decisions about how business will be conducted in the future." He advises that the best current training for IS isn't IS but liberal arts. "I'm looking for more extroverts, who have more of a bigger picture . . . of what computers can do for them—[and] for business."

Teachers of IS respond to these criticisms in a measured way. Many, like the University of Michigan's Severance, suggest that curricular changes are already de-emphasizing technology tools. "When I started teaching 16 years ago," Severance recalled, "we were fundamentally looking at the technology itself: database, telecommunications, programming languages and operating systems. Now more and more we're looking at how those information systems support and constrain a functional [business] area." Severance says the "tool" approach is fast losing favor because "tools have a half-life of five years."

ERIC CLEMONS *uses real-world research to develop exam questions.*

Indeed, many practitioners say they are going directly to the heart of business to help identify the issues of importance to students. Eric K. Clemons, an associate professor of decision sciences and management at the Wharton School of Business in Philadelphia, for example, uses his real-world research at such companies as Merrill Lynch and Lever Bros. to develop exam and research questions. Students writing essays on a particular problem or issue must defend their decisions the way IS managers would.

"I look at issues that are of long-term strategic significance to [business] management," Clemons said. For example, "Merrill Lynch at one point was trying to figure out whether to let Bloomberg Financial Markets [sell] a bond-trading system in which Merrill was a 30 percent owner. This gave me extremely timely information to use in class. The question was whether to let Bloomberg sell the system widely, and potentially to make millions, or whether to hold back on the investment because of the possible [damaging] impact it would have on the profitability of the bond market," Merrill's traditional line of business. Eventually an analysis was worked out that favored selling the system widely. Using this methodology, he explained, "my students get to think about what goes into making very successful entrepreneurs. [The bottom line] is that my students get hired."

It's true that no research or teaching environment can be perfect, but many IS managers believe that experiments like Clemons' are a step in the right direction. "Today's students—especially people coming out of graduate programs—have a lot more orientation to business processes, issues and skills than in the past," said Don A. Harder, area market director of management consulting practice, Northeast region, of Ernst & Young. "My sense is that the better mesh in skills is due to more-frequent and deeper interaction between companies and universities." But Harder believes that students are still lacking in on-site, seat-of-the pants consulting skills and need a more thorough grounding in "basic business processes," such as transaction flows, which are fundamental to getting started in business.

Ultimately, the strength of IS programs must come from a more intense involvement of businesses and a willingness of faculty to be open to new issues. "Universally, the programs that have had the active and real involvement of practitioners tend to be the best and the leading-edge programs," said James A. Senn, director of the information technology management group at Georgia State University in Atlanta. "Direct participation is essential—not just providing financial support, but truly being involved in the program and identifying projects and having influence on curriculum."

JAMES SENN: *Direct participation is a must.*

Wetherbe added that IS training lays a foundation that goes beyond tools or pure practicality. "University IS searches for underlying concepts, theories grounded in reality," he said. "In an IS class, you don't owe it to students to teach them the way [a problem is solved] at one company. You owe it to show them how it's done at a variety of companies, and how it's done best. You're providing something richer than a [single] experience. Students ought to know what works and why it works. You ought to teach them a frame of mind—how not to be duped." CIO

Arielle Emmett is a freelance writer based in Hewitt, N.J.

PHOTO LEFT BY EUGENE MOPSIK, RIGHT BY SONNY WILLIAMS

Going Beyond AI

Unlike traditional programs or even expert systems, artificial neural networks are able to reason beyond their own scope of experience

BY MICKEY WILLIAMSON

Automating the back office, it turns out, was the easy part. Now the pressure is on the information systems organization to supply applications that support critical business functions, many of which seem at first blush to defy automation.

How, for example, can a mail-order house use what it knows about its customers to decide which are most likely to order from the next catalog? How can an insurance company predict which claims are most likely to be dishonest, or a credit-card company anticipate fraudulent charges?

The answer to each of these questions lies buried in the masses of data that each company has collected in the normal course of business. Every executive knows that these corporate databases contain the information they need to make important decisions, but the information is difficult, often impossible, to get at.

Statistical analysis, the obvious and time-honored solution, requires that someone decide in advance which elements in a sample of the data actually contribute to a given result. The selection of the input information in statistical analysis, fraught as it may be with human bias and error, largely determines the output. Furthermore, conventional statistical methods break down where the inputs are ambiguous, or where some of the data is missing.

These problems go away when artificial neural networks analyze the data. A neural network—an information-processing technology that uses an approach entirely different from conventional algorithmic programming—can plow through a large database and find patterns in the information it contains, without prejudging which data points are important, and without choking on information that is unclear or incomplete.

Artificial neural networks are beginning to return significant value in an assortment of industries—financial services, food processing and manufacturing, to name but three. Success stories about neural networks are hard to find, not because they don't exist but because companies using them for strategic advantage are loath to alert their competitors.

"People are having good results, but there's a great reluctance to tell about it," said Casimir Klimasauskas, founder and chairman of NeuralWare Inc. in Pittsburgh, producers of PC-based neurocomputing software. "One of our customers, we have been told, has nearly 100 applications of neural networks deployed. My guess is that between $200 million and $300 million in investments is under portfolio management by neural networks."

"Many companies view this kind of technology as [providing] a competitive edge," said Jeff Farin, senior manager in the management consulting practice at Deloitte & Touche

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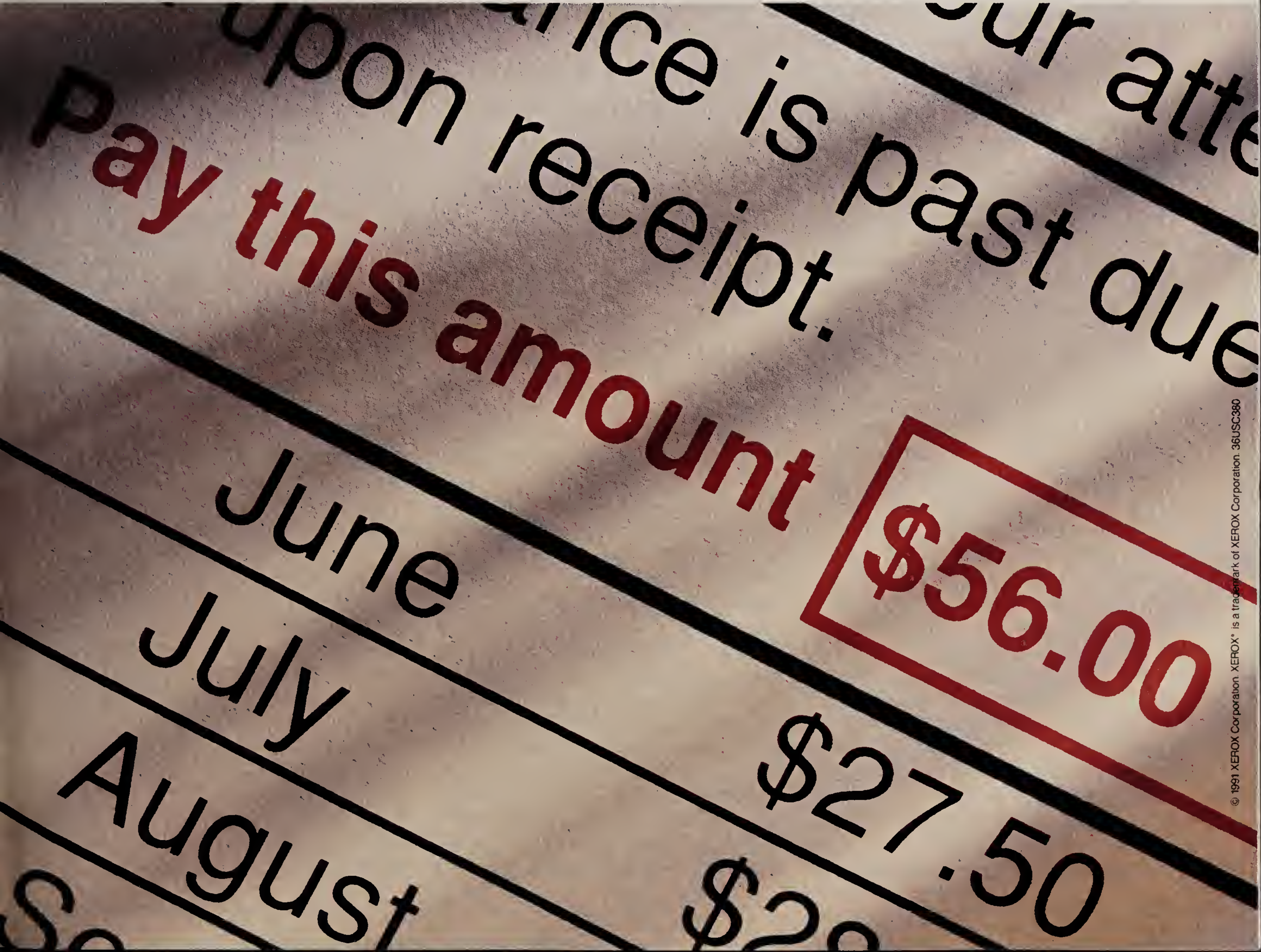

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in Parsippany, N.J. "It's a new enough technology that not many people understand how to use it. Given the competition in the financial-services industry, in particular, people are looking for any kind of leg up they can get. Neural nets seem to fall into that category."

Neural nets have made the difference between profit and loss for Dennis Regan, a private commodities trader in Bakersfield, Calif. "When I started trading, there was no way to make any money," he said. "I was paying commissions and barely meeting expenses. When I started using the neural nets, I was no longer a loser."

Regan developed his own neural network that uses daily data from 25 different commodities and financial indices to predict the behavior of the 18 commodities that he trades. "I wouldn't trade without it," he said. "I don't guess; I have predictions." Regan became a believer, he said, when he ignored one of his neural net's predictions and missed an $18,000 opportunity as a result.

Artificial neural networks have an edge over conventional expert systems in situations where it is difficult or impossible to narrow down the possibilities based on if/then/else structured approaches. A neural net, Farin explained, is "basically a heavy-duty statistical processor that allows you to contemplate collections of data and how they are related to each other."

Predicting which claims are fraudulent is a major concern of insurance companies, at least one of which has turned the problem over to a neural network. Standard practice, said Klimasauskas, is to use statistical methods to assign a score to each incoming claim, indicating the likelihood that it might be dishonest. Since companies lack the resources to investigate every incoming claim, only those with the highest scores are turned over to adjusters for investigation.

Klimasauskas said one company has improved the ratio of claims turned over for investigation to those actually found fraudulent by a factor of between three and five. In other words, for every 10 phony claims it used to spot, the company is now identifying between 30 and 50. "That may not seem like a very big improvement, but it has a tremendous monetary impact," he observed.

Outside the financial-services area, Sumitomo Heavy Industries in Japan has created a system that can distinguish subtle differences in apples streaming down a conveyor belt, counting and evaluating defects and assigning a grade to each piece of fruit. The Ford Motor Co. is reported to be working on a neural-net application that monitors a stream of data from microprocessors in a car, much as an expert mechanic might listen to the sound of an engine. The goal is a diagnostic tool for the assembly line or dealers' service departments.

A neural network can plow through a large database and find patterns in the information it contains, without prejudging which data points are important, and without choking on information that is unclear or incomplete.

One way to differentiate between tasks best suited to the capabilities of the serial computer and those that should be assigned to the inherently parallel neural network is in terms of the left brain/right brain hypothesis. This theory, supported by both laboratory experimentation and clinical observation of brain-injured individuals, suggests that the brain's left hemisphere specializes in logical, analytical and highly structured functions, while the right hemisphere takes the lead in intuitive and imaginative assignments. A serial computer, like the brain's left hemisphere, is ideal for managing your bank account and reconciling the monthly statement. The right-brained artificial neural network could discern your spending habits by looking at the past year's checks.

Because they are driven by data, not algorithms, neural networks require less time and effort to program. Because they learn by inspecting input data, their performance improves over time. And since processing is carried out by many elements working simultaneously on the same data, artificial neural networks are intrinsically fault tolerant. A serial computer will halt if its CPU fails. A parallel machine with a failed processor will yield incorrect results because some part of the data is not being worked on. But an artificial neural network can usually endure failure of up to 15 percent of its processing elements before its performance begins to degrade.

Expert systems at one time looked like the solution to the executive decision-making problem, but building useful expert systems to aid in complex decisions has turned out to be far more difficult than at first anticipated. Knowledge engineering, the process of turning what a human expert knows into machine-readable instructions, depends on the ability of an expert to impart special knowledge in the first place, something few experts can do. Their decisions are based on knowledge and educated guesses so deeply internalized as to be virtually inexpressible.

The other problem with expert systems is that the developer must provide for every conceivable outcome. Expert systems cannot be coded to give approximate answers. When faced with a problem they have not been taught to solve, they simply cannot function.

Artificial neural networks can overcome these deficiencies because of their inherent architecture and capabilities. While neural-net design is inspired by what little is known about how the brain processes information, neural computers are far from synthetic brains, although building a model of the brain is exactly what researchers hope to do. "It may take a thousand years," said Bernard Widrow, past president of the International Neural Network Society and inventor of a neural-net device used in long-distance telephone lines and high-speed modems. "But in a hundred years we should have made some real progress."

Those who claim that an artificial neural network models the brain exaggerate by orders of magnitude. The human brain consists of an estimated 10^{15} interconnections firing off electrical impulses at 10^{16} per second. The brain of the common housefly has something like 10^{10} interconnections firing at 10^{9} per second. By comparison, the Mark III neurocomputer, built by TRW for the Department of Defense, has 10^{6} (one million) interconnects and a firing rate of 500,000 per second; personal computers of the Intel '286 class have about 30,000 interconnects firing at 25,000 per second.

Clearly, then, we are generations, maybe centuries, away from building anything approximating the computational power of the human brain. Neural-net research—an interdisciplinary endeavor involving cognitive psychologists, neuroscientists, behavioral scientists, engineers, theoretical mathematicians and computer scientists—aims today at developing an understanding of how the brain processes information. The goal is to implement that understanding in hardware. Today, Widrow's adaptive echo-canceling filter and the TRW Mark III aside, nearly all artificial neural networks are executed in software.

Whether it is implemented in software, hardware, or a combination of the two, the basic component of a neural network is the processing element (PE), a rough analog of the brain's neuron. Processing elements are quite different from the central processing units in a serial computer. The latter are basically binary switches with only two possible states: on or off, 1 or 0. Neural-net PEs are more like resistors and amplifiers, with values ranging from 0 to 1 in minute decimal increments.

Each PE contains a summation function, which totals incoming signals from other PEs; a threshold, below which incoming stimuli will be ignored; and a transfer function, which determines the strength with which the summed signal will be transmitted to other PEs.

> *The neural network develops its own method of classifying incoming data, generalizing from data to conclusion and attempting to produce an error rate approaching zero. The neural-net term for this is adaptation; it is a form of learning.*

Processing elements are arranged in layers, which may be fully or partially connected with each other. Elements within a single layer may also be connected, either fully or partially, with each other. Signals may go from the input layer only in the direction of the output layer, or they may also feed error and output signals backward to tell processing elements in lower layers whether they are moving in the right direction.

These factors—number of PEs, number of layers, signal strengths, thresholds and connection patterns—define a neural network's architecture and learning rules.

In general, teaching a neural net to solve a class of problems requires that appropriate representations of the data pertaining to that problem be generated, and that either the full data set or a statistically significant subset of it be presented to the network along with the correct output for each example. Gradually, the neural network develops its own method of classifying incoming data, generalizing from data to conclusion and attempting to produce an error rate approaching zero. The neural-net term for this is adaptation; it is a form of learning.

The information-processing capabilities of an artificial neural network can be divided into three somewhat overlapping categories. First, neural nets are self-organizing: They categorize the information they receive and learn to recognize instances that are similar but not identical. Second, they generalize from problems they have seen to new problems of the same general class, and they can select an appropriate response to a new problem from among those belonging to its neighbors. Finally, neural nets retrieve information by associating it with related information; they do not require a memory address to find what they need.

None of the foregoing is true of serial computers. That does not imply that neurocomputers will—or should—replace what already exists. But it does point to a future in which our computers can do more than we have in the past expected of them. Just as the invention of the internal-combustion engine led to fundamental and unforeseen changes in our society, including the growth of suburbia and the end to the multigenerational nuclear family, it is reasonable to expect that artificial neural networks will yield results that we are unable to anticipate. Whether they will all be results that please us is an open question.

Mickey Williamson is a technical journalist based in Warwick, Mass., who specializes in emerging technologies. She edits the newsletter CASE Strategies.

EVENTS

8th Annual Computer Graphics Show

Javits Convention Center, New York
January 28-30
How *and* New Media *magazines*
301 587-4545

Featured are exhibitions, a full conference program and hands-on tutorials. Conference tracks include publishing and prepress, graphic design and illustration, animation and virtual reality, and multimedia and videographics. Registration fees: $175-$275.

The Business of IT: Finding the Payoff

Loews Coronado Bay, San Diego
March 8-11
CIO Publishing Inc.
1-800 366-0246 or 508 872-8200

Peter Drucker is the keynote speaker at this conference. Sessions focus on aspects of IT management, technology investments, competitive strategies and corporate business development. In addition, there are organized networking and discussion groups. Registration fees: $850-$1,295.

The National Re-engineering & Maintenance Conference

Sheraton Premier, Washington.
March 16-18
CASE Trends, *Digital Consulting Inc. and Keane Inc.*
508 470-3880

Effectively leveraging existing systems and resources is the focus. Industry consultants, users and tool developers discuss making the transition from maintenance to re-engineering. An exhibit of re-engineering products is also included. Registration fee: $895.

The 2nd Conference on Computers, Freedom and Privacy

The L'Enfant Plaza Hotel, Washington
March 18-20
George Washington University
202 994-7238

Conference sessions deal with ethics, morality and criminality, communications privacy, computers in the workplace, and free speech and the public telephone network. Featured speakers include Allen H. Neuharth, founder of *USA Today*. Registration fee: $65-$350.

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Value-Added E-Mail Networks

Hughes Aircraft's E-Mail network provides an infrastructure for companywide applications, streamlining business processes and speeding the dissemination of critical information

When Hughes Aircraft decided to link all of its employees worldwide via E-mail, it ran into a problem: Different business units were using about a dozen different E-mail systems. Each system was fine by itself, but taken together, they added up to an incompatible mishmash of multivendor software that had to be either scrapped or integrated.

Throwing out the old systems and replacing them with a single companywide one was not practical. Besides being a logistical nightmare, such an undertaking would most likely have encountered resistance from those end users whose familiar E-mail systems were nixed in favor of the new solution. Thus the goal of achieving easy, seamless communication among employees would have been undermined.

Consequently, Hughes chose to integrate. "We knew we had to connect the disparate E-mail systems if we wanted to get rid of the islands of automation," said Peter Donaghy, laboratory manager of customer services and support. "So we decided interconnectivity was the way to go."

The integration effort, started about six years ago, has gradually evolved into the Electronic Messaging Integrated Services, or EMIS. Currently, 25,000 Hughes employees at offices around the world are linked by the EMIS network. They are also linked to 75,000 people at parent company General Motors. Holding everything together is host-based software from Soft-Switch Inc. of Wayne, Pa., that transparently interconnects multivendor systems.

As expected, the communication process is now much faster and more concise. But according to Donaghy, the real value of EMIS is that it provides the architecture to develop and support mail-enabled applications. "Once you're past the interconnectivity, you've got to use the infrastructure to solve business problems," he said. "The mail-enabled applications provide a focal point to re-engineer business processes."

VITAL STATISTICS

Organization: *Hughes Aircraft Co., Los Angeles*
Application: *E-mail network*
Scope: *Employees companywide, suppliers and customers*
Sponsors: *Staff Vice president and CIO R.J. Wensley and the Information Systems Executive Council*
Technologies: *A global network of incompatible E-mail systems integrated by Soft-Switch multiprotocol E-mail switches*
Objective: *To improve communication by providing interconnectivity among disparate E-mail systems*
Payoff: *Increased the speed and accuracy of communication and facilitated the re-engineering of business processes*

EMIS is integrated with a videotext database network that can be accessed for a variety of applications, including electronic routing and approval (ERA). ERA provides electronic forms and routes them among employees. To complete the forms, users import standard information from the database. This has resulted in a significant reduction in data entry, according to Donaghy, and dramatically reduced the time needed for approval. "Documents that used to take days or weeks to get around now get around in minutes or hours," Donaghy said. "Not only does ERA reduce the cycle time of documents, but it has made some transactions paperless."

News-filtering applications are also possible with EMIS. Interested employees now receive individually tailored information extracted from the *Commerce Business Daily*. Information is automatically sorted by key words and technologies and delivered via E-mail to marketing and product personnel. "It's really been a boon getting the right information out to the people who need it."

End-user resistance can throw a wrench into any new system, but this hasn't happened at Hughes. The company monitors how many times messages must be translated from one system to another; in August, 75,000 such translations took place. According to Donaghy, this "indicates that there's a lot of communication going on." And thanks to the promotional efforts of CIO R.J. Wensley, EMIS is now funded at a corporate level rather than charged to end users on a per-transaction basis.

"We're really at the tip of the iceberg as far as applications go," said Donaghy. "As more are developed, we will continue to change the way we do business."

–Megan Santosus

"THE TASK IS TO INTEGRATE THE OLD AND THE NEW."
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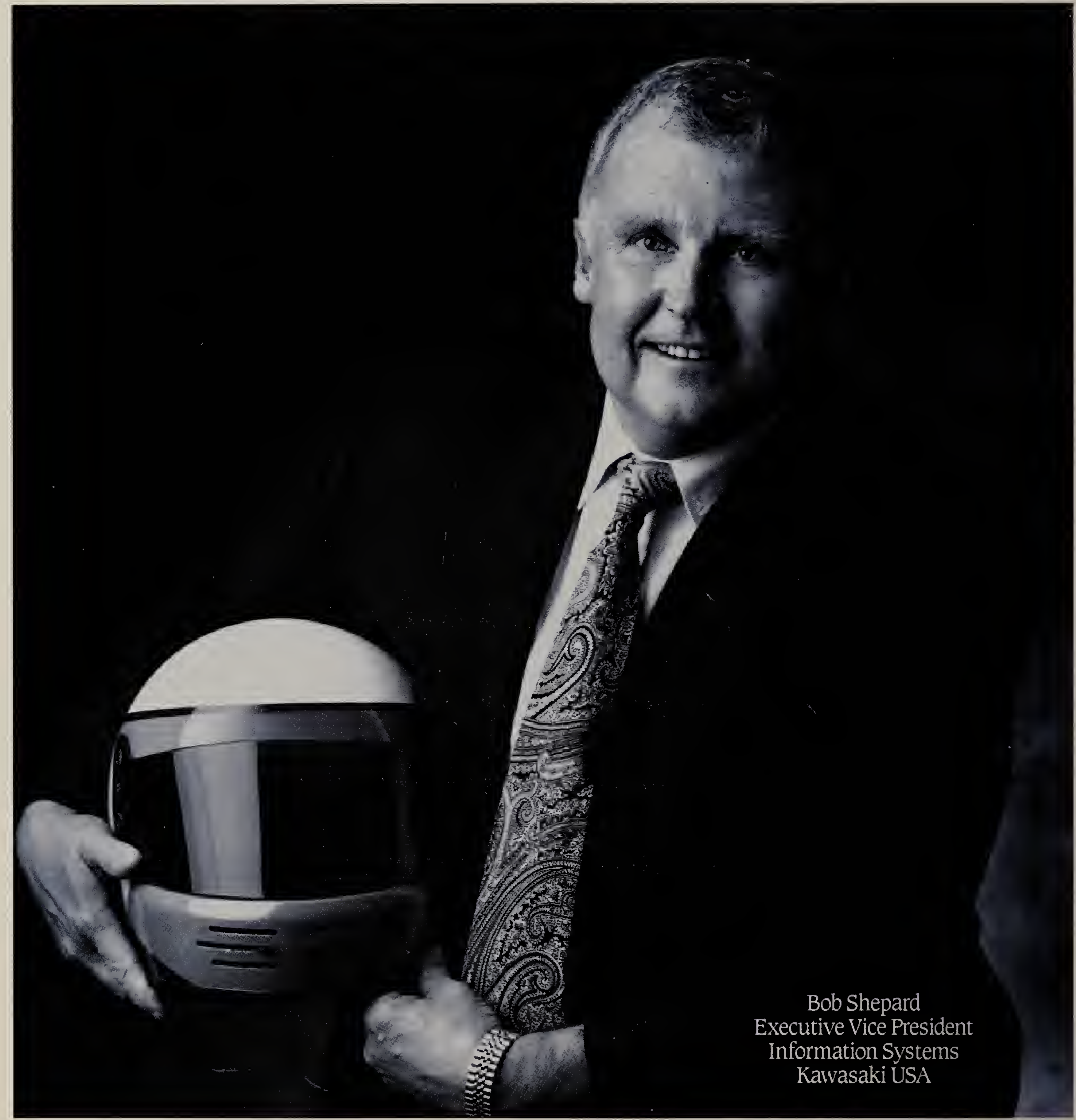

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